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REPORT
OF
HARBOR AND LAND
COMMISSIONERS

1897



ANNUAL REPORT

OF THE

**BOARD OF HARBOR AND LAND
COMMISSIONERS**

FOR THE YEAR 1897.

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Commonwealth of Massachusetts.

REPORT.

To the Honorable the Senate and House of Representatives of the Commonwealth of Massachusetts.

The Board of Harbor and Land Commissioners, pursuant to the provisions of law, respectfully submits its annual report for the year 1897, covering a period of twelve months, from Nov. 30, 1896.

Every year brings an access of business of a character which needs the personal attention of the commissioners. Every new subject matter over which the Board is given jurisdiction, or with reference to which an examination and report is required, brings with it a multitude of lesser requirements, such as the visitation of localities, conferences with individuals, examination of documents and answers to inquiries from others, which take up time.

In systematizing the business of the office, the Board has found it convenient to have a return day, on which parties petitioning may come in and be heard, either in person, or, as often happens, by counsel, whereby the hearings are now and again extended by continuances, in which questions of law and fact are presented and argued, and have to be finally determined by the Board.

In addition to its other duties, the Board conducts a bureau of information, relative to matters over which it has charge, and the inquiries relating thereto are repeated and constant. In order not to disappoint the public and to insure a regular and systematic performance of all its duties, the Board has substantially daily sessions for five days out of the week, and during all the business hours of each day it endeavors to have at least one of its members present.

In the past year one hundred and sixty-five formal hearings have been given, at which one hundred and eight petitions for licenses to build and maintain structures, and for privileges in tide waters and great ponds, were heard and determined; and of these, one hundred and four were granted, one withdrawn and three denied.

Of the hearings not given at the commissioners' rooms in the State House, two were given at Cotuit and Osterville on Sept. 9 and 10, 1897, under chapter 483 of the Acts of 1897, for the purpose of personal acquaintance with the locality and people, and of listening to the testimony of all parties interested in the construction of a channel from Osterville Bay to Vineyard Sound.

On Oct. 22, 1897, a hearing was given by the Joint Board of Harbor and Land Commissioners and State Board of Health, at Green Harbor, under the provisions of chapter 495 of the Acts of 1896 and chapter 98 of the Resolves of 1897, relative to the restoration of Green Harbor in Marshfield.

On Oct. 29, 1897, a hearing was given in Springfield, under the provisions of chapter 82 of the Resolves of 1897, relative to the improvement of the navigation of the Connecticut River.

All other hearings were given by the Board in Boston.

In addition to the licenses granted on petitions which have to be accompanied by plans and recorded in the various registries of deeds, the Board has granted sixty-six permits (for convenience so called) not requiring registration, some of which were accompanied by plans and required a formal hearing, whereas others were of a nature such as could be treated informally, without prejudice to the rights of third persons.

During the year the Board has made seventy-six inspections of premises necessary to be visited before granting petitions and privileges, and also for the sake of determining if the Board's directions had been faithfully carried out and authorized appropriations had been rightly and economically expended.

Among other places visited have been Provincetown, Gay Head, Chatham, Cotuit, Springfield, Beverly Farms, Agawam

and Holyoke. For the purpose of a personal inspection of the Connecticut River, the Board proceeded by water from Springfield to Holyoke on one occasion, and on another from Springfield to Hartford, Conn., through the Windsor Locks canal, in order that the problem submitted under chapter 82 of the Resolves of 1897 might be better understood.

In the pursuit of information relative to the latest improvement in the manner of building and equipping modern piers, with direct reference to the construction of the Commonwealth's pier at South Boston, the Board, with its engineer, has recently visited Philadelphia and New York, and consulted with the engineers connected with the improvement of the water fronts in those places.

SOUTH BOSTON FLATS.

On that portion of the Commonwealth's flats at South Boston south of Congress Street but little work has been required. The streets and sewers are generally in good condition. The carts of the street department of the city have continued during the year to deposit ashes and street sweepings on the blocks between C and E streets. On the area north of Congress Street material taken from cellar excavations and other similar sources and brought to the flats for a dump has been largely used for additional filling in the low spots caused by the settling of the material which was taken from the harbor and deposited on the lot leased to L. G. Burnham & Co. As the material of this class was insufficient to do all that was required at this place, a contract* was made, March 11, 1897, with the Bay State Dredging Company, the lowest bidder, to dredge about 4,000 cubic yards of material from the adjacent flats, and place the same on the filled land just inside the easterly bulkhead. Under this contract 4,356 yards were dredged and deposited, at a cost of \$808.97. The work was completed May 5, 1897. This material was carted onto the premises and spread there without cost to the Commonwealth.

In accordance with the provisions of chapter 392 of the

* See Appendix C.

Acts of 1897, a lease to L. G. Burnham & Co. of about 6½ acres of the filled land, together with a small wharf, was executed under date of April 1, 1897, for a term of fifteen years.

A contract with Albert A. Hersey for building the wharf aforesaid, which was in force at the date of the last report, was completed May 14, 1897, at a total cost of \$7,742.10. Upon completion of the wharf, the exposed condition in which vessels lying at it would be placed was observed, and it was decided that a breakwater to protect vessels from the northerly and westerly winds and waves would be necessary. For this purpose a breakwater 10 feet wide and 400 feet long, parallel with and 100 feet north-westerly from the wharf, was constructed, without expense to the Commonwealth, thus forming a protected berth for vessels lying at the wharf.

The dredging of a channel 75 feet wide, 18 feet deep and 1,550 feet long from the main ship channel to this wharf, under a contract with the New England Dredging Company, which was in force at the date of the last report, was completed April 15, 1897, at a cost of \$13,945. During this dredging a ledge was uncovered on the easterly side of the channel and about 120 feet northerly of the exterior line of occupation of the flats. This ledge projected about 20 feet into the channel and about 4 feet above the required depth. It contained about 40 cubic yards, lying above the grade of 18½ feet below mean low water.

After advertising for proposals, a contract* for its removal was made May 20, 1897, with Hiram W. Phillips of Quincy, the lowest bidder, at a cost of \$777. This work was completed June 22, 1897.

A buoy was placed near the entrance to the channel on the location of this ledge, and this entrance being at about the centre of the area assigned for the general anchorage of vessels in the harbor, was usually found occupied by some vessel at anchor when wanted for use as a channel. In order to bring the attention of masters of vessels to the entrance, that they might avoid anchoring in such a manner as to

* See Appendix D.

obstruct it, the Board requested the inspector of the light-house establishment for this district to place two buoys in the entrance to the channel. He at once complied with this request, and it is anticipated that no further difficulty will be experienced.

Capacious and expensive structures, equipped with every modern appliance for speedy and economical handling of coal on a large scale, have been erected on the premises leased, and relieve the location from its former appearance of remoteness and isolation.

Under the authority given by chapter 513 of the Acts of 1897, plans and specifications were prepared, and after due advertisement, a contract * was made with Messrs. Perkins, White & Co., under date of Nov. 15, 1897, to build the solid portion of a new pier on the northerly side of the Commonwealth's property, for the sum of \$198,416; the work to be completed Feb. 1, 1899. Before preparing these plans, careful studies were made as to the best location, proportions and method of construction for the proposed pier. The location finally determined on is east of and substantially parallel with Pier No. 4 of the New England Railroad Company, leaving a dock 175 feet wide between the face of the proposed pier and the boundary line between the Commonwealth's property and that of the railroad company. The plans of the railroad company provide for a dock 100 feet wide on its side of the boundary line, which, together with the width left by the Commonwealth, will make a dock 275 feet wide between the piers.

The pier when completed will be 400 feet wide and 1,200 feet long. The method of construction will be by building a central portion or core of solid filling, to be dredged from the adjacent docks. This will be enclosed by a sea wall of granite blocks resting on a foundation of piles driven to extreme low-water mark, the entire structure having a length of 1,150 feet and a width of 300 feet. Surrounding the piles a riprap of stone and gravel will slope down to the dock to a depth of 30 feet at mean low water. This slope will ultimately be covered by a platform 50 feet wide, to be con-

* See Appendix B.

structed outside and around the two sides and the end of the masonry, thus completing the projected width of 400 feet and length of 1,200 feet, and creating a surface of wharf area of about 11 acres, around which docks may be dredged and maintained to the depth of 35 and even 40 feet at low water if desired without danger of undermining the structure.

Work under this contract for the solid core and masonry was commenced the first of December.

Inquiry was early made with reference to occupation of the pier when completed, and now negotiations are in progress looking toward a long-term lease of the entire pier and docks.

It is essential to the proper development and occupancy of the proposed pier and entire water front of this Commonwealth flats property that it should have suitable and convenient railroad connections, and these could be readily arranged and maintained in connection with the tracks of the New England Railroad Company.

It is also planned in connection with the pier, to construct a proper approach for a car-float ferry, in order that carloads of merchandise may be transported from terminals on the north and east sides of the harbor to this pier without breaking bulk.

It is becoming recognized that the use of water-ways for distribution of freight at the end of a railroad terminal is the most economical means of conveyance.

As has been said recently in one of the leading engineering papers published in this country, in reference to distributing freight entering New York on the west side over the trunk line terminals and their proposed connections with New York by means of bridges and tunnels for the purpose of export: "The fact is, that, instead of the North River being a barrier to traffic under present conditions, it is really a vast distributing yard, with its tracks always maintained free of cost, and in which a train can move from one point to any other without obstruction or delay." . . . "The car-float goes from the Jersey City pier to any point on the East River, the Harlem River or the harbor; and, by reason of this enormous mileage of water front, a loaded freight car

can be delivered at a warehouse close to its final destination at less total actual cost than the switching charges for similar transfer in any other great city of the country."

In the ways thus indicated the Commonwealth pier will be in close contact with all the railroads entering Boston.

NORTHERN AVENUE.

Nothing has been done during the year towards the laying out or construction of Northern Avenue, but in order to fully utilize the new pier and dock now being constructed on the Commonwealth's flats, some action must be taken in this matter during the coming year.

The necessity for another bridge across Fort Point Channel is very pressing. Congress Street bridge is over-taxed, and is now in an almost dangerous condition. It was built in 1874, and is twenty-three years old. But few repairs have been made on the main portion of the bridge, with the exception of what have been absolutely necessary to keep the pavement from dropping through the floor. At the present time a portion of the sidewalk is fenced off as dangerous to travel. Many of the piles of the bridge require renewal, but the traffic is so great that serious inconvenience and expensive delays would be involved in shutting off traffic in order to make repairs. The construction of the new bridge at Summer Street, owing to its grade and the additional distance necessary to be traveled to reach the railroad freight yards, will not furnish adequate relief for this bridge.

The removal of freight yards to the New England locations will vastly increase the trucking across Fort Point Channel. In addition, the business traffic incident to the occupation of the new eleven-acre pier must be provided for. This requires that direct and not circuitous nor deviating routes should be established, leading straight to the centres of business. The time has therefore arrived when public necessity and convenience require the laying out and building of Northern Avenue and of Northern Avenue bridge across Fort Point Channel at the foot of Oliver Street. The landing on the west side was taken for that purpose by the city

in 1873, and, while awaiting the building of the new bridge, is temporarily used as a place for loading the offal scows which are towed to sea for the disposal of their cargoes.

The recommendations in this behalf made in the last report of this Board on page 7 are again most respectfully urged upon the attention of the Legislature. The large and valuable property of the Commonwealth at South Boston is ripe for utilization and development, and private interests should not be permitted to stand in the way of its expansion into an available asset.

CONGRESS STREET.

The commission appointed by the superior court under the grade crossing act for the abolition of the grade crossing of Congress Street, made by the tracks in the freight yard of the New England Railroad Company, the authority whereof was extended by chapter 535 of the Acts of 1896, completed its work and filed its report on March 10, 1897. The report was accepted by the court, and a decree* was entered on March 13, following. This decree provides for the discontinuance of that portion of Congress Street which lies between the easterly and westerly side lines of the New England Railroad Company's property, and in lieu thereof further provides for the construction of a new street 100 feet wide in extension of Summer Street, starting from the harbor line on the Boston side of Fort Point Channel, crossing Fort Point Channel by a steel bridge resting on stone piers and abutments, with a double sliding draw, having a passageway for vessels 50 feet wide, and thence crossing property of the Boston Wharf Company, of the railroad company and of the Commonwealth to a junction with existing Congress Street at its intersection with D Street. From this point Congress Street is widened to 100 feet as far as the sea wall on the northerly side of the reserved channel. This new Summer Street is to be an elevated structure, starting at grade on the west side of Fort Point Channel, and rising with a maximum grade of $1\frac{1}{4}$ per cent. to the railroad property, where it is $24\frac{1}{2}$ feet above the present grade of Congress Street. Crossing the railroad property at a level, it descends with a

* See Appendix I.

maximum grade of $1\frac{1}{2}$ per cent. to the present grade of Congress Street, at a point about 260 feet east of E Street. The existing streets which it crosses, together with the tracks in the railroad yard, are to be spanned by steel bridges, supported on stone and steel piers and abutments.

A new cross street 80 feet wide, in extension of Dorchester Avenue, is to be built along the harbor line on the west side of Fort Point Channel from the end of the new street to Congress Street, and Congress Street from Atlantic Avenue to the harbor line is to be widened from 60 feet, its present width, to 80 feet.

Two approaches are to be built to the elevated portions of the new Summer Street on the easterly side of Fort Point Channel. One will be 60 feet wide, with a grade of 1.7 per cent., from a point on the new street near the harbor line, along substantially the location of the old main line tracks of the New England Railroad, to A Street. The other approach is wholly on land of the Commonwealth. It starts at the intersection of the new street with D Street, and follows D Street 80 feet wide to Fargo Street, and thence along Fargo Street 50 feet wide to C Street, where it reaches the existing grade of the streets on the Commonwealth's property. The grade of this portion of the approach is about $1\frac{1}{2}$ per cent. From Fargo Street it follows C Street to Congress Street, passing under the new street.

The roadway throughout the entire length of the new street and its approaches is to be paved with granite blocks, with the exception of the movable draw of the bridge over Fort Point Channel. The sidewalks on the bridges are to be paved with asphalt. On the other portions the sidewalks will be of brick, plank or crushed stone.

Under the decree, the work of building the bridge over the railroad tracks is to be done by the railroad company. All the other work is to be done by the city of Boston.

The decree also provides that the expense of the whole work shall be borne jointly by the Commonwealth, the railroad company and the city of Boston, in the following proportions: the Commonwealth, 31 per cent.; the city, 30 per cent.; the railroad company, 39 per cent. High commendation is due to the office of the Attorney-General for the skill

and ability with which the case of the Commonwealth was prepared and conducted.

Since the filing of the decree, work on the preparation of plans for the necessary structures has progressed, and a contract has been executed for the construction of the abutment at the Boston end of the bridge over Fort Point Channel. Work will be advanced on the balance of the structures during the coming season.

Uncertainty as to what the determination of the commissioners would be, and, since their report was filed, as to how soon the work could be carried out, or how damages were to be adjusted, has made it impracticable for this Board thus far to shape any definite plans for future action, or even to give absolute assurances to parties seeking information relative to the purchase or improvement of the Commonwealth's property, although many inquiries have been made respecting portions of the Commonwealth's flats lying south of Congress Street.

The situation relative to selling the land adjacent to the new street is still further complicated by the action of the Boston Real Estate Trust in instituting proceedings to disturb the decree of the commissioners.

The fulfilment of this project involves taking from the Commonwealth for street purposes, in addition to what has already been taken by the city, 286,768 square feet of land. Of this, 217,756 square feet are within areas which the Commonwealth has already set apart for use as streets on the South Boston flats. Of the remainder, 66,404 square feet are taken from areas on the South Boston flats previously designed to be used for business purposes; and the balance, 2,608 square feet, are in the tide waters of Fort Point Channel within the harbor line on the Boston side, and are taken for widening Congress Street between Atlantic Avenue and the harbor line.

COMMONWEALTH'S FLATS IMPROVEMENT FUND.

The balance in the Commonwealth's flats improvement fund on the first day of December, 1896, was \$75,475.21. To this has been added during the year \$5,103.41 from the

income of the fund and \$54,815.37 from sales and rents of land and from other sources, making a total of \$135,393.99. Of this sum there has been expended during the year \$29,228.68, leaving an available balance on Nov. 30, 1897, of \$106,165.31.

SURVEYS, ETC.

Surveys in every direction are constantly increasing, and call continuously for time and labor. The force in the office has been increased to meet the growing demand and enable the work to be done without deterioration in quality and with regard to the maintenance of the usual high degree of efficiency.

In December, 1896, and January and March, 1897, lines and grades were given at various times for the construction of the wharf at the South Boston flats, built under contract with Albert A. Hersey, and in March and April surveys were made of the channel which was dredged by the New England Dredging Company as an approach to this wharf, which has been leased to L. G. Burnham & Co.

Lines and grades for the construction of drains and the laying of water pipes by the city through the streets on the South Boston flats have been given from time to time throughout the year; and in September and October surveys and soundings were made on the location of the new pier now under construction. In November the necessary surveys were made for staking out and defining the lines for the work of construction of the pier. In December, 1896, and January and February, 1897, soundings were taken over the areas dredged under the contract with the New England Dredging Company, opposite the Grand Junction wharves at East Boston. During the same months surveys were made over the areas dredged under contract with the Eastern Dredging Company, opposite the Mystic wharves of the Boston & Maine Railroad Corporation in Mystic River, Charlestown.

On March 2, at the request of the superintendent of the coast survey, a few lines were run and soundings made opposite the Navy Yard, to see if any changes had been made there since the last survey in 1892.

On March 5, soundings were taken opposite the wharf of

the Boston Electric Light Company on Fort Point Channel, to determine if any shoaling had been caused there by the dumping of material at the foot of Summer Street extension.

March 8 to 10, soundings were taken in the canal leading to the wharves on the Cambridge side of Charles River, near Craigie Bridge, to determine the amount of shoaling which had taken place there from various causes.

In May and June the topographical survey of the Connecticut River between the towns of Hatfield and Hadley was continued, and the first sheet of the survey, which was reported as partially completed last year, was substantially finished.

May 13 to 17, surveys were made at Beverly, to determine the location of the mean high-water line on the premises of Messrs. Swan & Woodberry.

In June, July and November, the topographical survey of the Mystic River was continued, two sheets being completed and a third one nearly so. This work is a continuation of the general resurvey of Boston harbor, which the Board is completing gradually, keeping it ahead as much as possible of general improvements, in order to study the best methods of making them and to furnish data for advising with and assisting engineers and others who are planning improvements along the water front. These surveys form the basis from which the Board calculates the areas of public land which are to be occupied by licensed structures, as well as the amount of tide water which is displaced by their building. The surveys are prosecuted from time to time each year whenever the field party can be spared from more pressing duties.

On June 7, surveys were made to determine the location of the bounds which are to be placed by the towns to mark the boundary line established by chapter 302 of the Acts of 1897 between Marion and Wareham.

In June and November surveys were made and bounds were set to mark the boundary line between the towns of Gay Head and Chilmark, established by chapter 323 of the Acts of 1897.

In July, August and September surveys were made of the

bays and inlets forming the harbors of Cotuit and Osterville, in connection with the investigation which was being carried on by the Board under the provisions of chapter 483 of the Acts of 1897.

October 18, surveys were made to determine the location of various borings which had been made by private parties in Charles River above West Boston Bridge.

November 17, a survey was made to determine the location of the harbor line on the easterly side of Fort Point Channel, south of Mt. Washington Avenue Bridge.

In the latter part of November and the first part of December surveys and soundings were made between Wood Island and Jeffries Point at East Boston, to determine the extent and location of the various channels through the flats.

The results of these surveys have been plotted and permanent records of the information have been made and filed in the office and many plans have been drawn based on these surveys, for the use and information of the Board and others.

In addition to the foregoing, many small surveys and examinations have been made for the purpose of determining the amount of tide water displaced by various structures which have been built in tide water under licenses from the Board.

Since moving into new quarters, the plans and records have been arranged and made more readily accessible. The work of mounting and repairing old plans and arranging and indexing them has gone on with rapidity. Now they are practically safe from danger by fire. Calls for information from engineers and others are constantly increasing. These inquiries cover a large range of subjects. The larger part can be answered by reference to the manuscript plans and notes of surveys. A large number, however, relate to matters concerning which the Board and its engineers have collected many plans, reports and other information from various sources since its organization, and have preserved and arranged collectively in the office, so as to be easily accessible at all times. Much work of this kind remains to be done, and will be prosecuted as time can be spared from more pressing duties.

BOSTON HARBOR.

The growth and concentration of business at the port of Boston creates a constant demand for increased accommodation. Wider and deeper channels are needed, and the Federal government is supplying them with reasonable speed.

Already the main ship channel has been dredged to a depth of 27 feet at mean low water, with the width of 1,000 feet from the entrance at Boston Light to the Narrows, and a contract has been entered into for continuing that same depth and width up to the city wharves.

In addition, a new ship channel out from President Roads straight away through Broad Sound has been surveyed during the past summer, and is found feasible. It is projected to have a depth of 30 feet at mean low water and a width of 1,200 feet, thus meeting the requirements of the largest of modern steamships, and is estimated to cost something under a half million dollars. This same width and depth ultimately without doubt will become the dimensions of the main channel, as far up as the Navy Yard.

The Commonwealth meanwhile has been doing all in its power to prepare suitable accommodation in the upper harbor by dredging in places not contemplated by the Federal government, and yet outside private ownership and occupation, for the steamships of increased size already plying between this port and Europe.

By chapter 330 of the Acts of 1896 an appropriation of \$150,000 was made by the Legislature, to be expended in dredging the areas lying between the ship channel in Boston harbor and the wharves over areas which were not provided for in the last appropriations made by the Federal government. At the date of the last report two contracts were in force under this appropriation. One was with the New England Dredging Company, to dredge about 127,000 cubic yards from areas in Boston harbor opposite the Grand Junction wharves in East Boston. This work was completed in a satisfactory manner March 1 of the present year, and there is now, in consequence thereof, ample area and depth of water for transatlantic steamships of the largest class, coming to these wharves, to navigate with safety.

The other, for dredging about 218,000 cubic yards near the Mystic Wharf of the Boston & Maine Railroad corporation at Charlestown, was satisfactorily completed early in February. This work, upon the completion of the project which the Federal government now has under contract, will give a channel having a depth of 27 feet at mean low water from these wharves to the sea, thus providing a capacious and convenient water-way for vessels of the deepest draught to the largest grain elevator on the Atlantic coast.

Acting upon the recommendations of the State Board on Docks and Terminal Facilities, the Legislature last winter appropriated \$100,000, and authorized the Board to take by purchase or otherwise certain parcels of flats at East Boston, to secure the same for future use and enjoyment in the interest of maritime commerce. The flats covered by authority of chapter 486 of the Acts of 1897 are in many different parcels, in the hands of widely scattered owners; and the delays incident to carrying on negotiations under these circumstances, as well as to making surveys of the premises, have prolonged the time within which the Board had hoped to accomplish its object. Some doubt if the amount of the appropriation were going to be large enough to cover the desired acquisition of territory has required extraordinary caution in conducting negotiations. The Board, however, is not without hope of making the acquisition.

A further liberal appropriation of \$400,000 was made by chapter 513 of the Acts of 1897, for the purpose of constructing a modern pier at South Boston, as hereinbefore recited.

The preparation of the port for its due share of the growing commerce of this country is thus receiving attention from both the Federal and the State government; and when all projects are completed, it will be second to none in safety for entering and navigating at all stages of the tide by the largest vessels that are building.

FORT POINT CHANNEL.

This channel has been improved by the Federal government, by excavation to a width of 175 feet, with 23 feet of depth at mean low water, from its entrance to Congress Street bridge, a distance of 1,900 feet.

The full project for this improvement is the excavation of a continuous channel of these dimensions, from the entrance to near Federal Street bridge, a distance of 4,100 feet, which is estimated to cost \$100,000.

Further progress in this improvement has been awaiting the reconstruction of the New England Railroad bridge, which, out of the rearrangement resulting from the location and construction of the Southern Union Railroad Station, will be now wholly removed.

On Sept. 7, 1897, the Board granted a license to the city of Boston, under the provisions of chapter 19, Public Statutes, and chapter 535 of the Acts of 1896, to build a steel girder bridge on stone piers, with retractile draws on a pile foundation, and pile draw piers, across Fort Point Channel, the clear passageway for vessels through said bridge to be not less than 50 feet wide. The above license of the Board was granted subject to the laws of the United States, and was on condition that all of the present pile bridge and draw pier of the New England Railroad Company across said channel between the harbor lines shall be removed to the satisfaction of the Board; that a channel shall be dredged from deep water on the easterly side of the draw-pier of Congress Street bridge in and through said bridge to and through the draw-way of the bridge so licensed, to connect with the present channel between said last-named bridge and Mount Washington Avenue bridge, to a depth of 16 feet below mean low water, and 50 feet in width at said depth, to the satisfaction of the Board.

On Aug. 12, 1897, the city of Boston submitted a petition for approval of plans for a bridge on the line of Dorchester Avenue across Fort Point Channel, as authorized by chapter 512 of the Acts of 1897, said bridge to be constructed under the provisions of chapter 516 of the Acts of 1896.

Under the authority conferred upon the Board by this act of 1897, such changes in the harbor line may be made by the Board as will, in its opinion, facilitate the construction of Dorchester Avenue, said bridge and draw, in an economical and proper manner.

At the hearing on this petition, given Aug. 19, 1897, certain owners of wharf property on the South Boston side

of the channel appeared in opposition to the approval of the plans presented, on the ground that their property would be injured. The hearing was continued to enable the city engineer to make further study as to grades. Plans have not as yet been approved.

On Sept. 2, 1897, the Board approved plans, under section 8, chapter 19 of the Public Statutes, submitted by the Boston Terminal Company for filling solid the tide-water area lying westerly of and adjoining the westerly side line of Dorchester Avenue extension, and between the southerly side line of Summer Street extension and the easterly side line of Federal Street, on condition that such bulkheads shall be built as may be required by the Board, to retain the filling. This approval and license was given "without waiving any of the rights of said Commonwealth to claim, demand and recover any and all damages suffered by the taking of land under the provisions of chapter 516 of the Acts of 1896."

On January 5, 1897, the Boston Terminal Company took certain tide-water lands of the Commonwealth in Fort Point Channel, within the harbor line established by chapter 170 of the Acts of 1880, and between the northerly side line of Summer Street extension and Federal Street bridge. Under various licenses granted by the Board during the past twenty-three years for the extension of wharves on Fort Point Channel within the above limit, the Commonwealth has received payment for its tide-water lands covered by these extensions, under the provisions of section 16 of chapter 19 of the Public Statutes. The receipts from this source are now paid into the harbor compensation fund for Boston harbor, under chapter 146 of the Acts of 1897. The claim of the Commonwealth for payment for its tide-water lands which the Boston Terminal Company has taken under chapter 516 of the Acts of 1896 has been placed in the hands of the Attorney-General.

On Sept. 3, 1897, the Board, under section 8 of chapter 19, Public Statutes, approved plans submitted by the city of Boston for a sea wall to be constructed on the harbor line on Fort Point Channel from the northerly side line of Summer Street extension to the easterly side line of Federal Street, and for filling in tide water within the lines of Summer Street

extension and Dorchester Avenue extension, as authorized and directed by chapter 516 of the Acts of 1896, the license for this work containing a provision for payment for tide water displaced.

SOUTH BAY.

As intimated in the report of last year, the exclusion of the business occupants of the wharves on Fort Point Channel, to give room for the new Southern Union Passenger Station, has stimulated the demand for wharf properties in other directions. Especially does this seem to have been the case in the upper part of Fort Point Channel and South Bay. At the southern end of the bay the Roxbury Central Wharf corporation has projected three piers and two docks, going out to the harbor line, which are to be occupied when built as lumber wharves.

The material for filling is to be taken from the bay. This will not only tend to improve the navigation therein, but will diminish the opportunity for it to become a nuisance. The project would seem to insure the future of the bay as an inland terminal for bulky coastwise products coming by water.

MYSTIC RIVER.

July 14, 1897, the Board granted a license to the Boston & Maine Railroad corporation to fill flats and build a pile platform on Mystic River between its Western Division bridge and Mystic and Middlesex avenues in Somerville.

The petitioner desired to fill flats and build a pile platform beyond the pierhead and bulkhead line approved by the Secretary of War. This license was granted on condition that the licensee should dredge the whole of the area between the outer line of structures and the main navigable channel of Mystic River, and between its Western Division bridge and Middlesex Avenue bridge, excepting the area adjoining and 50 feet outside the lines of said Western Division and Middlesex Avenue bridges, to a depth of not less than 3 feet below mean low water, under the direction and supervision of the Board.

The proposed filling and structures beyond the United States pierhead line were approved by the Secretary of War.

The river at this point has a wide sweep or bend, with the main channel lying well over north of the middle line, and exhibits at low tide a wide area of unsightly flats. The advantages to be gained by lowering these flats to a plane of 3 feet below mean low water, both from the æsthetic as well as the utilitarian and sanitary point of view, more than compensates for the loss in the tidal prism at this spot.

CHARLES RIVER.

The river Charles, both in its bed and on its banks, is undergoing gradual improvement in appearance and in usefulness. The project for improving the channel has been carried forward by the Federal government, so that it now is 200 feet wide and 7 feet deep at mean low water, from its mouth to Western Avenue bridge. Beyond that, as far up as the Arsenal Street bridge, it has a least depth of 6 feet and a least width of 80 feet, and when the Market Street bridge shall be remodeled, the Congressional appropriation will permit of the channel being enlarged still farther up the river.

Meantime, the Metropolitan Park Commission and the Park Commission of Cambridge have acquired the larger part of the river bank, from Harvard bridge to Watertown, excepting such as, on account of the costly improvements, could not be readily controlled.

These possessions are being transformed into parks and boulevards as rapidly as circumstances will permit. The experiment of treating the banks during the past year by sloping and gravelling has been found successful and to be more attractive and less costly than stone bulkheads, such as are necessary or desirable below Harvard bridge.

Considerable quantities of gravel are found along the river bottom in different places belonging to the Commonwealth, and have been freely granted in the furtherance of the park improvement. While thus permitting of its appropriation to public uses, the corresponding benefit to navigation which accrues from deepening the bed of the river has not been lost sight of.

During the year the city of Cambridge, under the provisions of chapter 508 of the Acts of 1896, and the owners of

flats lying between West Boston bridge and the land of the Charles River Embankment Company, have combined in a project for improving their unsightly territory, and applied to the Board for licenses as their respective interests seem to require. Hearings were given by the Board, at which the mayor, city solicitor, members of the Park Commission and other leading citizens of Cambridge were present. Licenses, while temporarily delayed awaiting adjustments among the landowners, will issue to build a sea wall, enclosing the tidal basin in the rear, and to fill the same with material taken from the ugly flats lying between the site of the proposed sea wall and the channel of the river, with a view to lowering them below the plane of extreme low tide; and it was agreed that, in assessing compensation for tide water displaced by the work to be done, deduction should be made, yard for yard, for material used for said filling when taken from these flats.

The existence of a large bed of marketable gravel, having an area of about a million square feet contiguous to the proposed sea wall and extending nearly to the channel, stands in the way of immediate improvement of a considerable portion of these exposed flats. The efforts of the Board to have this material removed were resisted, on the ground that the gravel was too costly for the proposed filling, and insistence in that direction would imperil the whole project. After listening to a unanimous expression of the opinion on the part of the official representatives of Cambridge that leaving this area to be exposed for the present would be unobjectionable, and to the statement of the Park Commissioners that the gravel would be needed in the near future for surfacing the boulevards and grading and gravelling the river banks, in accordance with the projected requirements of the park system, the Board determined the depth and areas to be dredged, without encroaching on the gravel bed.

NEW BEDFORD.

The Board gave several hearings during the year on matters connected with the harbor of New Bedford, at which opposition to the granting of any license to fill flats out to the present harbor or channel line developed. The objec-

tions were based on the theory that, if all owners of flats were permitted to build solid to the present channel lines, under the provisions of chapter 18 of the Acts of 1806, as defined by chapter 269 of the Acts of 1848, the water across would become too contracted for the requirements of modern commerce, the character of which had so greatly changed during the past half century and the future of which was so uncertain; and that, while the Federal government was providing for the future by an additional width in the draw of the new bridge between New Bedford and Fairhaven, some steps ought to be taken toward withdrawing the present lines, in order still more to restrict encroachments into tide water. Out of this have grown suggestions for changing the channel or harbor lines or of establishing bulkhead and pierhead lines, beyond which neither solid filling nor structures should be authorized.

A hearing was given on June 22, on the petition of the county commissioners of Bristol County for approval of plans for the middle section of the bridge on Acushnet River between New Bedford and Fairhaven. A remonstrance was made against the approval of the plans in so far as showing a draw between Pope's and Fish islands. All parties were represented by counsel. Testimony was taken and arguments made. Subsequently an inspection of the locality was made by the Board. It appearing that the Federal government proposed to widen and deepen the channel in the line of the proposed draw, and favored the placing of a draw where planned, in view of the anticipation of increased commerce up the river, and for reasons of public convenience and of navigation, the Board approved the plans and ordered the license to issue.

Later, authority was granted allowing the street railway, running over the old bridge, and the city of New Bedford, respectively, to build temporary pile structures in connection with the destruction of the old and the building of the new bridge across the water between the two islands, with a view to diminishing, as far as might be, the inconvenience caused to public travel while building the new bridge in substitution of the old one.

FALL RIVER.

The growing commerce at this port is keeping pace with the increase of the city in population and manufacturing industry, and is demanding additional wharf accommodations. As no harbor line has been established here to determine the limits of encroachment into tide water, it will become desirable at no distant day to place a restriction upon the erection of structures therein.

GREEN HARBOR.

Any consideration of the questions which might have arisen had the Board been called upon to act under the provisions of chapter 495 of the Acts of 1896, in removing the dam and dike at Green Harbor, becomes unnecessary, in view of the unanimous conclusion of the Joint Board that it will report against such removal. It would seem as if the instructions to this Board to make a report were intended to operate only in case the determination of the Joint Board should be in favor of removal; and, inasmuch as the Joint Board will make a full report of its findings, any report from this Board covering the same ground and reaching the same conclusions would be superfluous.

OSTERVILLE AND COTUIT HARBORS.

By chapter 483, Acts of 1897, the Board was instructed to cause an examination to be made by competent engineers of the waters of Osterville and Cotuit bays, for the purpose of determining whether a channel for the passage of vessels might be cut through the beach between South Bay and Vineyard Sound without injury to Cotuit harbor; and the sum of \$8,500 was appropriated to defray the expense of the survey and of the cutting of the channel and attendant damages, in case the Board should find it could be done without injury to Cotuit.

The Board directed its engineer to take immediate steps for a thorough examination and survey of the premises, and to report thereon as soon as practicable.

Subsequently the Board gave hearings on the subject at Cotuit on September 9, at which some fifty-nine of the

citizens and summer residents were present, and on September 10 at Osterville, when some sixty-six of those interested were in attendance.

It appeared that the average amount of business of Cotuit from oysters, quahaugs and cord wood was about \$22,000, to which must be added the proceeds of the sale of about 425 tons of coal and 150,000 feet of lumber. There is a large summer population, resident not only at Cotuit but all along the shore to and beyond Osterville, who use and enjoy the waters of all the bays which empty through Cotuit harbor into the Sound.

No voice was heard to express a desire for the proposed channel, if it were likely to result in shoaling Cotuit bar off the entrance to the harbor. The proposed channel would be used largely by fishing boats and pleasure yachts from Osterville, which now are obliged to sail down through North Bay, the Narrows and Cotuit Bay, a distance of $4\frac{1}{2}$ miles, before entering the Sound.

The report * of the engineer shows an exhaustive examination of the locality, covering not only the inland waters of Osterville and Cotuit, but extending into the Sound for some distance along the shore. To enable the engineer to draw safe and satisfactory conclusions, it was necessary to determine and occupy triangulation stations, to survey shore lines, to run lines of levels and take soundings, to establish tide gauges and mathematically observe full tides and high and low waters, all of which doings covered a period of some ten weeks of field work by a corps of engineers and assistants, besides a month in the office working up the results. A detail of this work will appear in his report.

The report finds Cotuit Bay with an area of about 295 acres, forming the harbor of Cotuit; next above that are the Narrows, so called, with an area of about 127 acres; above that again is North Bay, having an area of about 326 acres, with the village of Osterville lying at its easterly end; southerly of and connected with this is South Bay, with an area of about 334 acres, through which, and a cut excavated through the sand beach, Osterville inhabitants desire to find

* See Appendix A.

a nearer passage to the Sound. The depth of navigable water generally throughout these areas varies from about 4 to 6 feet, though in some places it is deeper. The southerly portion of South Bay, however, where it is proposed that the cut should be made, is very shallow, in some places not even one foot.

In passing through Cotuit Bay and the Sound, the waters of each tide follow several channels, of which the middle one (the more direct course between Sampson's and Gull islands) finds the bar wider and carrying but from $2\frac{1}{2}$ to 3 feet at mean low water; while the Rushy Marsh channel takes a more circuitous course, hugging the shore on the west, and making a shorter distance over the bar, where the depth at mean low water is about $3\frac{1}{2}$ feet. While the evidence showed that the depth of water on the bar had not varied materially during the past fifty years, the direction and width of the channels have met with considerable changes. The eastern channel has been practically closed by the growing extension of Dead Neck beach westerly toward the southerly end of Sampson's Island. The middle channel has been broadened and shoaled by the wearing away of Gull Island, and, while there is apparently a slight increase in depth, according to the testimony the channel is growing over what once was Gull Island; and, while earth and lighter material have been washed away and distributed in the harbor and adjacent areas, bowlders have remained, sinking as the soil was washed away from underneath them, but leaving them a dangerous and unseen obstruction to safe navigation.

The western or Rushy Marsh channel is not only narrow and crooked, but, owing to the trend of drifting material westerly from Gull Island and from the Popponesset shore north-easterly, is growing gradually narrower, and navigation in that channel after nightfall is hazardous, if not impracticable. As a consequence, vessels caught out at low ebb tide after nightfall find it dangerous to attempt to make the harbor by way of any of the existing channels. In addition to this, many of the former deep areas are fast filling with the drifting sands. The changed conditions are attributable to the gradual washing away of the headlands and islands and the drift material carried along the shore.

There can be no doubt that the channels at the entrance of Cotuit harbor, such as they are, owe their preservation to the rapid current during the last half of the ebb tide.

If it shall be ascertained that the volume and velocity of the ebb tide will be unaffected by digging a cut of given dimensions from South Bay to the Sound, there will be safe reason to believe that such a cut can in no way do an injury to Cotuit harbor.

The main question to be determined then is to what extent "the volume and velocity of the tidal flow through the Cotuit entrance would be affected, providing such a cut should be made through the beach from the South Bay as would create a navigable channel for boats drawing in the neighborhood of 3 or 4 feet."

The report gives the areas in square feet of the various sheets of water contributing to the flow through the entrance of Cotuit harbor; also the mean range of tide and the mean tidal volume in cubic feet of each area. From these data we find that the mean range of tide in Cotuit Bay is $34\frac{1}{4}$ inches, while in South Bay it is but $25\frac{3}{4}$ inches. The mean range of the tide in the Sound in this locality is about 3 feet. The area of South Bay is 14,570,000 square feet.

The difference between the mean range of tide therein and in Cotuit Bay is $8\frac{1}{2}$ inches, notwithstanding Sepuit River affords an entrance and exit for tide water at the southerly end. The difference of $8\frac{1}{2}$ inches in the mean range of tide over the area of South Bay will supply a volume of water adequate to preserve a channel of the dimensions calculated through the beach, without in the least diminishing the volume of water that will continue to flow through Cotuit Bay or retarding the velocity of its flow.

This conclusion disposes of the question of injury to Cotuit Bay, and leads to the consideration of the locality where the cut should be made and the means by which it should be effected and preserved, as well as to the dimensions of the cut itself.

If the excavation should be made on the east side of Dead Neck, it was claimed at the hearing at Osterville that a demand for damages would be made for separating it from Wianno. The amount of damages which could be proved is

of course doubtful, but could be wholly avoided by making the proposed cut on the west side of Dead Neck, unless the east side should prove the better location.

A careful view of the situation discloses but little superiority of one place over the other, but such as exists seems to be in favor of the west side. The cut is desired largely for the use of sail boats. On the east side of the neck there would be a narrow water-way, from which for more than half way up to the bridge at Osterville the wind from the west and north-west would be cut off by the high land and trees on the neck; whereas, on the west side of the neck there is an uninterrupted opportunity for the enjoyment of these breezes, as well as those from the south-west, which latter, as is well known, are the prevailing winds on that coast in the summer season. Under all the circumstances the west side has been selected as the most suitable place for the cut. It is shown on the accompanying plan, printed in the Appendix.

Owing to the slight rise and fall of the tide and the constant drift along the shore, it would be exceedingly unwise to make a cut through the beach without protecting it by jetties carried out to a depth of 3 to 4 feet at mean low water; otherwise shoaling and bars would be likely to form on the outside, and the purpose of the cut would be defeated.

A calculation of the cost attendant upon this project has somewhat exceeded the allowance for that purpose made by the last Legislature. It would be necessary to cut a channel 2,850 feet long into South Bay, before finding depth of water sufficient to float the ordinary sail boat. This channel, to be convenient and serviceable, should have a main width of 100 feet. It should begin on the three-foot curve at the south end of the bay, and be carried directly through the beach to a depth between the three and four-foot curve in the Sound. Through the beach and out into the Sound it should be protected by wooden bulkheads and pile and timber jetties. The least expenditure required to accomplish this is estimated to be \$8,250 for the necessary excavations on land and under the water, and \$5,639 for the oak piles, spruce timber, bolts, nails and labor necessary for the struct-

ure. These sums together make \$13,889, or more than double the amount the Board has on hand for the work projected.

It was at first proposed to make the cut through the beach 175 feet wide and 3 feet deep, because it had been found that the surplus tidal prism of water in South Bay would permit of a cut of these dimensions without danger of affecting the volume or rapidity of the flow of water through Cotuit harbor, and it was intended to supplement this cut by one 200 feet wide within South Bay. It was found, however, that the estimated cost for excavations alone would amount to \$16,500.

Upon mature consideration of the needs of the Osterville people, and the purposes for and conditions under which this outlet will be used, the Board is satisfied that sufficient accommodation will be afforded by a cut 100 feet wide, and, as that will reduce the required expenditure by \$8,000, it is thought that the smaller channel ought to satisfy all requirements.

If this and other boat harbors or inlets are to be constructed along our sandy coast, it must be realized in the beginning that the first cost is considerable, in order to ensure a permanent character to the project. The cost of dredging the inlet is one-half the entire expense in this case; but, without the protection afforded by the additional cost, it would soon be of little value, and the outlet liable to be closed up by the violence of a storm.

Of the \$2,000 specially appropriated for survey and examination of the locality out of the \$8,500 generally appropriated under the act, the sum of \$1,929.53 has been expended. An additional appropriation of \$7,500 would enable the Board to excavate the cut and build the jetties under the estimates already given.

BOUNDARY LINE BETWEEN GAY HEAD AND CHILMARK.

In the last report (page 19) are narrated the doings of the Board under the provisions of chapter 187 of the Acts of 1896, for the purpose of determining the boundary line between the above-named towns, a description of the line by courses and bounds and the recommendations relating thereto.

By chapter 323 of the Acts of 1897 the boundary line thus defined was established, and the Board was directed to locate and mark the line by setting stone bounds wherever required; and also, whenever one or both of said towns or one or more of the inhabitants of said towns should agree, with such sureties as are satisfactory to the Board, to close the existing outlet of Menamsha Pond and excavate a new one through the beach on said boundary line, subject to the approval of the Board, then the Board is authorized to build suitable protection to the banks on either side of said outlet for the purpose of marking the boundary line at this place, and \$2,000 was appropriated for carrying out the work.

In June were made the necessary surveys for determining the location of the bounds necessary to mark the line, and arrangements were completed for the sum of \$12 to have new monuments prepared and set at two points,—one near the old wharf at Menamsha Inlet and one on the island between that and the outlet. These were to mark that portion of the line which was established on the recommendation of the Board. Upon making the surveys, it was found that the mouth of the inlet had moved since the date of the surveys of the previous year about 150 feet to the westward, and was then substantially on the boundary line, so that all that was necessary to do to mark the line at this point was to build the protection to the banks which was authorized by the statute.

After due study, plans and specifications were prepared for building two pile and timber jetties, one on either side of the mouth of the outlet, 125 feet apart and extending about 400 feet into the sound to where the water was about 10 feet deep at low tide; and proposals for building the same were invited, to be opened on July 28, 1897. Two proposals were received, one of Chas. E. Davis of New Bedford for \$3,290, the other of B. C. Cromwell, Jr., of Vineyard Haven, for \$5,000. As both these amounts largely exceeded the sum appropriated by the Legislature for the work, they were necessarily rejected.

The advisability of so modifying the protection works that they could be built within the appropriation was then considered; but after consultation with the engineer it was

finally decided that it would be inexpedient to make any change, inasmuch as the works as originally designed were the least expensive that could be constructed in that place, with reasonable expectation of making a fairly permanent improvement.

The setting of the monuments to mark the other portion of the line has been completed, and a plan showing the location of the line and bounds has been prepared ready to be filed with the Secretary of the Commonwealth and in the registry of deeds for the county of Dukes County, as required by the statute.

Of the \$2,000 appropriated last year, the sum of \$136.40 has been expended in the foregoing work, leaving a balance available for jetties of \$1,863.60.

If it shall be the will of the Legislature to make permanent the outlet by building the proposed jetties, an additional appropriation of \$2,000 will be required.

It is worthy of consideration that the proposed permanent outlet would provide an accessible harbor for vessels drawing not over 6 feet of water at a point in Vineyard Sound where such a harbor is very much needed. Beside the advantage to the settlements at Gay Head and Chilmark, it would afford a safe and convenient harbor of refuge for the many yachts and sail boats which in the summer months frequent the Sound. In case of sudden stress of weather, with the wind from the northward or eastward, Holmes Hole and Vineyard Haven might often be found to be remote and inaccessible, whereas a refuge at Menamsha would prove a haven of easy access.

BOAT HARBORS.

The New England coast offers a healthful summer climate, and its attractions bring hither families from all parts of the country; but, while both the population and the wealth of the nation are increasing, the coast line remains fixed, consequently every year sees new settlements crowding the points and bays available for camps and cottages.

This summer occupation brings and distributes among the smaller seaports and coast villages an almost incredible amount of money, and has without doubt preserved many a New England town from absolute decay. A recent statistical

computation made by official authority of the State of Maine gave \$10,000,000 as the sum of money left within the borders of that State by the annual tide of summer travel and residence.

The seashore of the Commonwealth, with the exception of a comparatively few rocky bays and promontories, presents a front of sandy slopes and dunes, constantly shifting by the action of currents, winds and tides. For long distances the coast line is low and the approaches are shallow, while behind are reaches of water separated from the ocean by narrow necks of sand, through which streams flow from time to time in different places and in varying depths, under changing conditions disturbed by the elements of nature. What once were good entrance channels and harbors, amply sufficient for schooners of the coasting trader, now departed, are often at the present day not more than percolating rivulets, meandering a sinuous course through the sand bars, and hardly deep enough at ordinary low water to float the shallowest skiff.

Behind these entrances are, in many cases, an ancient village, revived, repainted and prospering, owing to the advent of the summer visitor; or a cluster of new cottages, the nucleus of a growing settlement. Out of this new condition or situation springs a desire for a safer entrance to the harbor, that may be availed of in case of sudden change of weather or at any stage of the tide. It is needed to protect the life and property of the fisherman, as well as the sojourner seeking for health and pleasure.

The policy of the Federal government is declared against appropriations for the improvement of harbors where no local commerce exists, and consequently any relief to be afforded in that direction will have to come from the action of the Commonwealth in such cases as may seem of sufficient importance to deserve assistance.

GARBAGE DEPOSITS IN TIDE WATER.

Complaints have been made to the Board from time to time of unsightly conditions on the surface waters of Boston harbor and Massachusetts Bay and along the shores of the high-water line between Nahant on the north and Scituate on

the south, caused by the deposit of the garbage of the city of Boston in the tide waters of the Commonwealth outside Boston Light.

The proper disposition of the garbage of great cities has long been a difficult problem, and has occasioned much thought and experimentation. The city of Boston solved it for the time being by carrying her garbage out to sea and dumping it in the bay. A considerable portion sinks, but a considerable portion also floats upon the surface. That which floats is a noisome sight, and by the action of the winds, the waves and the tides is often carried along and finally deposited upon the shore line of the uplands making down to the sea. In the summer season the beaches and rocks lying between Nahant and Scituate are the resort of the public in the pursuit of health and recreation, of which the enjoyment of sea bathing forms a not inconsiderable part. These offensive accumulations have a deterring effect on the mind of the would-be bather, and thus diminish his enjoyment of his rights and privileges at the seashore. The annoyance and offensiveness of this condition of affairs is too obvious to dwell upon.

Individual citizens, corporations and the Commonwealth have spent generous sums of money for the purpose of encouraging the enjoyments of the seashore, whereby increased health and happiness are promoted. The Metropolitan Park Commission alone has done much to render Revere Beach attractive and to forward the interests of the bathers.

It is admitted that the sanitation of the city is the foremost consideration, and that the interests of the few are to be sacrificed in the interests of the many, whenever that is the only alternative; but, since the temporary solution by Boston of the disposition of its garbage by taking it to sea, science has been at work making many experiments, and its disposal by either crematory or reduction processes is no longer tentative.

In the light of the advancement in science, it no longer seems reasonable that municipalities should be permitted to create nuisances in the disposal of garbage in the tide waters of the Commonwealth.

BOUNDARY LINE BETWEEN THE TOWNS OF WAREHAM AND MARION.

Pursuant to the provisions of chapter 302 of the Acts of 1897, the Board, accompanied by its engineer, the selectmen of the town of Wareham and the selectmen of the town of Marion, met on the ground and located and caused the portion of said lines south and east of the mouth of Weweantit River to be located and defined by range marks placed on the shores, and subsequently approved the monument to mark the bounds and the inscription to be placed thereon.

PROVINCE LANDS.

Continuing the policy which the Commonwealth determined on after the able report of the Trustees of Public Reservations, made to the Legislature in 1893, the sum of \$3,500 was appropriated last winter for the purpose of carrying on the work of reclaiming these lands, and of preventing further liability to injury from the blowing sands.

During the planting season of the past year, through April, June, September and November, the large number of 42 acres have been planted with beach grass, among which has been thickly interspersed small trees and shrubs, transplanted from the nursery. In addition to this, acorns, the seed of pine and other trees have been sown broadcast as the grass was planted; and, as this seed readily germinates and grows rapidly in this soil, we look forward to a forest growth to cover these outer dunes in the not far distant future. The number of trees and shrubs transplanted during the season, of different varieties, is not far from 36,500. Of these, about half were yearlings and the other half had from two to three years growth. The latter were all pines of different varieties.

There has also been planted, on the grassed slopes covered in the years 1895 and 1896, some 30 acres with the seed of the various kinds of pines. Some 400 feet of the road in the direction of the Race Point Life Saving Station has been added. This is a much-travelled way, of increasing use to the inhabitants; and the Board hope, by gradual ex-

tensions at such times as planting is inadmissible, to advance it economically toward completion.

It is gratifying to be able to report that not a single breach among the vegetation has occurred since the plantings, and that no movement of sand is apparent in the plantations, thus showing effectual control of the former action of the winds. The same appropriation continued for a few years longer will remove all apprehension of danger from a movement of the sands.

In accepting the resignation of Mr. Leonard W. Ross, as landscape forester, an expression of the appreciation of the Board for his valuable services, rendered gratuitously, throughout the experimental stages of reclamation of the Province Lands, up to the present time, is due. His election as a member of the Legislature has now led him to resign his connection with the Board.

The report * of the Superintendent of the Province Lands, gives a detailed account of the work accomplished during the year.

WRECKS.

The contract for the removal of the wreck of the steamship "Venetian," abandoned to the Commonwealth by both owners and underwriters, made July 30, 1895, with George W. Townsend, was completed by its final removal from the channel Sept. 28, 1897. The boilers had been placed on the flats in the vicinity of Governor's Island, where they were later broken up and the material removed. On Oct. 31, 1897, Mr. Townsend, as agent for the Commonwealth, reported that he had sold material to the amount of \$30,916 55, and that he had material unsold to the value of \$1,723.80, which he would buy of the Commonwealth at that price, and, it being a fair valuation, his offer was accepted. By the terms of the contract, one per cent. of the proceeds of the sale of the material belonged to the Commonwealth, the other ninety-nine per cent. being the compensation which the contractor was to receive for his work. A bill of sale was given Mr. Townsend of the material on hand at the above valuation, and he paid into the treasury the sum of \$326.39,

* See Appendix E.

which was one per cent. of the total proceeds of the sale of the material from the wreck.

Other wrecks removed by the Commonwealth during the year were the "W. F. Miller" of Barnstable, a small wood schooner which was wrecked at the entrance to Cotuit harbor, and the yacht "Galena."

The "W. F. Miller" was removed, under contract * with Charles E. Davis of New Bedford, for the sum of \$250, he being the lowest bidder, the material being placed on the beach near by, with the consent of the owner thereof.

The sloop yacht "Galena" was sunk in the channel on the northerly side of the "lower middle" in Boston harbor by collision with the steamer "Cape Ann." She was removed, under contract † with George W. Townsend, for \$49, he being the lowest bidder. She was taken up bodily and placed on the filled portion of the Commonwealth's flats at South Boston.

The steamer "Lillie" was partially burned on the morning of Sept. 13, 1897, at Sagamore Hill in Hull, and the wreck was complained of as liable to become an obstruction to safe and convenient navigation in Hingham Bay. After some correspondence with the owner and the insurers, the owner undertook to remove her.

BACK BAY LANDS.

The encroachment of business into the residence section of the Back Bay has led to a change in the character of buildings, and to a desire for a release from some of the restrictions imposed by the Commonwealth on that locality when laid out with reference to a contemplated residence section of the city.

On the 12th of March, 1897, the Board considered a petition from the Boston and Roxbury Mill Corporation, asking for a release from the operation of a mortgage given to the Commonwealth June 9, 1854, and recorded with Suffolk Deeds, lib. 665, fol. 152, on two parcels of land bounding on Commonwealth Avenue and adjacent to what was formerly known as Heath Marsh, in order to enable it to give a clear title to the Riverbank Improvement Company, the purchaser of the same.

* See Appendix G.

† See Appendix H.

After becoming satisfied that the Commonwealth had other and sufficient security that every part of the plan to secure the performance of which said mortgage was given would be fully completed and finally carried into effect, the Board approved the request of the Boston and Roxbury Mill Corporation, and thereupon a release was executed by the Treasurer of the Commonwealth.

On the 14th of September, the petition of the Boston and Roxbury Mill Corporation was considered, and certain private ways laid out over the parcel of land at the corner of Deerfield Street and Bay State Road, on land hitherto unimproved, were modified by changing the locations of the said private ways or back alleys thereon, with a view to giving increased accommodation and value to the abutting land.

GREAT PONDS.

The questions arising during the past year under the provisions of chapter 318 of the Acts of 1888, giving jurisdiction to this Board over great ponds, have been both novel and important; among them were the following: —

On June 16, 1897, the New Bedford Water Board petitioned for approval of plans for a dam between Great Quitacus and Pocksha ponds in Bristol County, by authority of chapter 345, Statutes of 1894. On July 7, 1897, the Board gave a hearing on this petition, the petitioner and the towns of Middleborough and Lakeville being represented by counsel.

It was objected at the hearing (1) that in the taking the water Board had transcended its powers; (2) that, in case a license should be granted, a fish-way and a boat-way over the dam or otherwise should be provided and gates for obstructing the flow of water should be constructed. After hearing the evidence and arguments, the Board reached the following conclusion: —

That the petitioners were authorized by the act of the Legislature to construct a dam between the two ponds, and that, having done the acts contemplated as preliminary to the filing of the present petition, it is not within the province of the Harbor and Land Commissioners to inquire whether in so doing the authority of the legislative grant in the taking of land and water contem-

plated therein has or has not been exceeded, and consequently it is neither necessary nor advisable to determine that question.

It has long been the policy of the Commonwealth to secure to the inhabitants of large towns and cities a pure water supply for drinking, domestic and municipal purposes, by appropriating to such uses the waters of great ponds exclusive of all other public rights and uses. The Legislature has granted these rights and the courts have maintained these grants on the grounds that lesser and inferior public rights and privileges must yield to more urgent demands of greater exigency. Purity of water supply is essential to the health of a community, and the condition surrounding any given situation upon which such purity depends must be determined by scientific considerations under the action of local authorities.

The act in question authorizes the building of a dam between the two ponds, and contemplates the possibility of a permanently lower level in greater Quittacus. The right to maintain such lower level permanently is beyond question. No provision is made for fish-ways or boat communication between the ponds. This Board has no right to interpolate them into the statute.

The plans presented are apt and adequate for the preservation of the conditions required by the act and appropriately designed to serve the purposes intended. They accordingly meet the approval of this Board, and the license will issue as requested.

On June 24 a petition for lease of an island in Washacum Lake in Sterling was received, which the Board declined to grant, on the ground that Washacum Lake empties into the proposed reservoir on the Nashua River, under the control of the Metropolitan Water Board, and it was thought best not to take the risk of any possible pollution of the lake by permitting any one to occupy the island in question.

On July 8 a hearing was given on the petition of the city of Worcester for license to build a bridge in substitution of a portion of the causeway across Lake Quinsigamond. The bridge was designed with an arched span in the centre 70 feet wide, flanked by two smaller ones on either side with a span of 40 feet each. Objections were made to the granting of the license on several grounds of a more or less technical nature, not properly to be determined by this tribunal; also upon the ground that, if a bridge were to be built, it should be of iron or steel, and more expensive than the one proposed.

The Board, however, were satisfied that the mayor and others representing the cities interested were entitled to proceed so far as the license from this Board could afford them the opportunity, and that validity of the objections offered could be raised and settled by the tribunal properly constituted for the determination of questions of that character without prejudice, if a license were granted ; and, if a license were refused, a proposed public benefit might be defeated without just reason. Consequently the license issued.

CONNECTICUT RIVER.

The general care and supervision of the Connecticut River and its banks were given to the Board by chapter 344 of the Acts of 1885. Between 1888 and the present time a number of appropriations have been made for protecting the banks at Hadley, West Springfield and Agawam. All work of this character for which appropriation was made has now been completed, with the exception of a trifling amount remaining to be done at Agawam. By chapter 58 of the Resolves of 1897 an appropriation of \$1,500 was made for completing the protection of the Agawam bank.

The work this year has been done, as heretofore, under the immediate supervision of Mr. E. C. Davis of Northampton, civil engineer, to the entire satisfaction of the Board. He has employed laborers and contractors, and worked in conjunction and harmony with the selectmen of Agawam. The report * of the engineer shows all necessary details.

Up to 1896 no appropriation had been made for the general survey authorized by the act of 1885. In 1896 an appropriation of \$1,000 was made for beginning this survey. Under this appropriation about $6\frac{1}{2}$ miles of the river have been surveyed, based on the triangulation done under the direction of the Topographical Survey Commission. The maps required by the statutes to be filed at the registry of deeds will be made during the coming winter. A small continuing appropriation each year would enable this work to be carried on in the most economical manner. For the general character of and necessity for this work, reference is respectfully made to pages 35 and 36 of the last annual report.

* See Appendix F.

WORK OF THE UNITED STATES IN RIVERS AND HARBORS
OF THE COMMONWEALTH.

The following statements, made by Lieut.-Col. Samuel M. Mansfield, Corps of Engineers, U. S. A., who is in charge of river and harbor improvements in eastern Massachusetts, and by Maj. D. W. Lockwood, Corps of Engineers, U. S. A., who is in charge of similar improvements in southern Massachusetts, show the work accomplished by the United States government in the rivers and harbors of this Commonwealth during the year : —

STATEMENT OF LIEUT.-COL. S. M. MANSFIELD, CORPS OF ENGINEERS, U. S. A.

DEC. 31, 1897.

*The Harbor and Land Commissioners, Commonwealth of Massachusetts,
Boston, Mass.*

GENTLEMEN : — In accordance with your request of the 3d inst., I have the honor to furnish the following summary of the work done by the United States during the year 1897, in the rivers and harbors of Massachusetts which are under my charge : —

Newburyport Harbor.

The project for the improvement of the harbor has not been changed. The river and harbor act of June 3, 1896, appropriated \$16,000 for the harbor. During the year 13,002 tons of rubble-stone were deposited in the south jetty under a contract with the Rockport, Pigeon Hill and Cape Ann Granite companies. It is now about 1,800 feet long.

The annual survey of the bar, made in June, 1897, developed two distinctive channels through the bar, of about equal width and depth, one channel directly east from the mouth of the river, the other extending southward along the shore of Plum Island.

Since the survey was made the south jetty has been extended 250 feet, and it is expected that the next survey will show the effect of the extension in the further development of the easterly channel.

Harbor of Refuge, Sandy Bay.

The project remains unchanged. The act of June 3, 1896, appropriated \$150,000 for this improvement, and this sum will be expended in continuing the building of the substructure of the breakwater.

During the year operations were continued under two contracts, one with the Cape Ann Granite Company, the other with the Rockport, Pigeon Hill and Cape Ann Granite companies. Under the first contract 125,600 tons, and under the second 84,232 tons, of rubblestone were deposited in extension of the substructure of the breakwater.

Gloucester Harbor.

No change in the project has been made. The act of June 3, 1896, appropriated \$34,000 for this harbor. Of this sum, \$2,000 was expended in the summer of 1897, in removing a pinnacle rock in the outer harbor, south-west of Ten Pound Island Ledge, to a least depth of 16 feet at mean low water, and five projecting points of rock near the ferry landing at Rocky Neck, in the inner harbor, to the level of the surrounding bottom. The remaining \$32,000 will be expended in the extension of the substructure of the Eastern Point breakwater, under a contract with the Rockport, Pigeon Hill and Cape Ann Granite companies. Under this contract 23,456 tons of rubblestone were deposited in the breakwater during the year.

Manchester Harbor.

Under provisions in the river and harbor act of June 3, 1896, a project of improvement of this harbor was prepared and submitted on July 30, 1897, providing for dredging the natural channel to a depth of 6 feet at mean low water, 100 feet wide at the entrance and at sharp bends, at least 75 feet wide throughout, with two turning or anchorage basins, one just below the Boston & Maine Railroad bridge, the other abreast of the town landing.

The estimated cost of this improvement is \$25,000.

Lynn Harbor.

No change has been made in the project. The act of June 3, 1896, appropriated \$20,000 for continuation of the improvement.

As much as was necessary of this amount was expended during the year in completing the project of dredging. The inner main ship channel was widened to 200 feet, 10 feet deep at mean low water; 54,092 cubic yards were dredged from the channel, under a contract with Mr. Augustus B. Martin; and the inner and outer main ship channels are now 10 feet deep at mean low water and 200 feet wide throughout.

Nothing more remains to be done under the project but the construction of the training wall to aid in keeping the outer channel open, and the necessity for this wall is not yet apparent.

Boston Harbor.

No change has been made in the project for its improvement. Operations were continued during the year, under the contract with Messrs. Townsend & Johnston, for the removal of the ledges uncovered by dredging done in the lower main ship channel, and the contract was completed in November, 1897. There were 4,951 cubic yards of ledge removed during the year, and the completion of the contract secures the full use of the lower main ship channel so far as it has been completed.

The act of June 3, 1896, appropriated \$70,000 for the harbor, as follows: "Improving harbor at Boston, Massachusetts; continuing improvement, seventy thousand dollars: *provided*, that this sum may, in the discretion of the Secretary of War, be used in the preservation and improvement of said harbor, including the project for improving the main ship channel, and that seven thousand dollars of this sum may, in the discretion of the Secretary of War, be used in improving Chelsea Creek, and so much thereof as the Secretary of War in his discretion shall direct to be expended for the protection of Great Head, Winthrop, to prevent the further washing away by the action of the sea: *provided*, that contracts may be entered into by the Secretary of War for such materials and work as may be necessary to carry out the revised project of August eleventh, eighteen hundred and ninety-two, such contracts to provide that said ship channel shall be widened to a minimum width of one thousand feet and a minimum depth of twenty-seven feet, to be paid for as appropriations may from time to time be made by law, in the aggregate not to exceed one million one hundred and forty-five thousand dollars, exclusive of amount herein and heretofore appropriated."

The \$7,000 allotted for Chelsea Creek has been expended under a contract with the Eastern Dredging Company. The project of improvement of this channel provides for a channel 150 feet wide, 18 feet deep at mean high water to the head of navigation, at an estimated cost of \$65,000. There were 22,236 cubic yards dredged in making the improved channel 14 feet deep at mean high water, at least 35 feet wide.

The Secretary of War decided to expend no part of the appropriation of June 3, 1896, for the protection of Great Head, Winthrop, and the balance of \$63,000 will be used to cover cost of supervision of the continuing contract for the improvement of the main ship channel.

On Feb. 11, 1897, a contract was entered into with Messrs.

Breymann Brothers of Toledo, O., to dredge 2,910,718 cubic yards, more or less, of material from and in completion of the proposed main ship channel, the contract to be completed on or before June 30, 1900.

The sundry civil act of June 4, 1897, appropriated \$400,000 for this work, but active operations were delayed while the contractors were engaged in assembling their plant, and not commenced until November, when one dredge of large capacity was placed on the work in the lower main ship channel; only about 60,000 cubic yards have been dredged to date, and the operations as yet have resulted in no well-defined improvement over the former condition of the channel.

The river and harbor act of June 3, 1896, provided for a survey of Boston harbor, "with a view to securing a channel one thousand two hundred feet wide and thirty feet deep from the navy yard to the entrance of the present main ship channel, and from the main ship channel in President Roads through the Broad Sound Channel."

A survey of the Broad Sound Channel was made in the summer of 1897, and on Nov. 19, 1897, a project was submitted for a channel 30 feet deep, 1,200 feet wide, in accordance with the above provision.

The estimated cost of the project after the channel 1,000 by 27 feet has been completed was, for the channel from the Navy Yard to President Roads, \$1,644,553.90; from President Roads through the Broad Sound Channel, \$481,941.57; from President Roads to the entrance of the present main ship channel, \$1,557,621.72; total, \$3,684,117.19.

Scituate Harbor.

No change has been made in the project of improvement. The \$6,000 appropriated by the act of June 3, 1896, was expended during the year, under a contract with the Eastern Dredging Company, in deepening the entrance channel from 5 feet to 7 feet at mean low water, with a least width of 100 feet.

Plymouth Harbor.

Repairs and extensions to the bulkheads protecting Long Beach in the vicinity of the "Pavilion" were made during the year.

Wellfleet Harbor.

No change during the year.

Provincetown Harbor.

The bulkhead protecting the narrow stretch of beach near Wood End Light was strengthened by extending the upper bulkhead 225 feet to the eastward.

Chatham Harbor.

No change has been made in the condition of the harbor during the year.

Merrimac River.

During the year about 205 tons of bowlders were removed from the channel of the river below Rocks Bridge.

On May 5, 1897, an estimate of cost of a channel 150 feet wide and 7 feet deep at mean low water, from Newburyport to Haverhill, was submitted, in accordance with the river and harbor act of June 3, 1897. The cost of this improvement was estimated to be \$171,442.70.

Powow River.

During the year operations were concluded under a contract with the Eastern Dredging Company to dredge 25,000 cubic yards of material from the river.

The channel is now 12 feet deep at mean high water, at least 30 feet wide throughout, and is 45 feet wide for a length of 3,252 feet from its upper end.

Essex River.

Five thousand dollars was appropriated for this river by the river and harbor act of June 3, 1896. This sum was expended during the year, under a contract with the Eastern Dredging Company, in widening the upper part of the channel from the highway bridge downward for a distance of about 4,400 feet to its full projected width of 60 feet, 4 feet deep at mean low water.

Mystic and Malden Rivers.

The sum of \$10,000, appropriated by the river and harbor act of June 3, 1896, was expended during the year, under a contract with Mr. Augustus B. Martin, in completing the channel in Malden River below the first bridge, 100 feet wide and 12 feet deep at mean high water; and in Mystic River, by extending the proposed channel of full width and depth for a distance of 4,000 feet, or to within 6,200 feet of the head of navigation.

Town River.

No change has been made in the project. The river and harbor act of June 3, 1896, appropriated \$10,000 for this improvement, which was expended during the year in dredging the channel 50 feet wide and 4 feet deep at mean low water from the mouth to Johnson's wharf, in Quincy, and 30 feet wide from Johnson's wharf to the stone yard wharf.

Weymouth River.

The sum of \$5,000 available for Weymouth (Fore) River at the beginning of the year has been expended in completing as far as possible the full proposed improvement in the upper part of the channel. This channel is now completed above Braintree bridge, and below the bridge it is at least 60 feet wide and 6 feet deep at mean low water.

The project for Weymouth (Back) River proposed to dredge a channel 200 feet wide and 12 feet deep at mean low water through the outer bar and up to the Fertilizer Company's wharf. The sum of \$12,500 available for this improvement at the beginning of the year has been expended in completing the channel through the bar, and in dredging it at least 100 feet wide and 12 feet deep at mean low water to the Fertilizer Company's wharf.

Wrecks.

The wreck of the schooner "Annie E. Rudolph," located about $2\frac{1}{2}$ miles east by north of Orleans, Cape Cod, Mass., was removed under a contract with Mr. L. E. Lunt.

Examinations and Surveys.

The act of June 3, 1896, provided for surveys and projects for the improvement of the following:—

Merrimac River, from Lowell to New Hampshire State line.

Marblehead harbor, with a view to improving the harbor by building a sea-wall to protect the isthmus connecting Marblehead Neck with the town of Marblehead.

Provincetown harbor, with a view of erecting a dike for the protection of that harbor.

Neponset River.

Lynn harbor, with a view to securing a channel 300 feet wide and 15 feet deep at low water.

Boston harbor, with a view to securing a channel 1,200 feet wide and 30 feet deep from the Navy Yard to the entrance of the

present main ship channel, and from the main ship channel in President Roads through Broad Sound Channel.

Manchester harbor.

Harbor at Plymouth.

Weymouth Back River, from Hingham bridge to Mann's wharf.

With the exception of the Merrimac River and Boston harbor, these surveys were made in the fall of 1896; and the reports thereon have been submitted under the following dates: Marblehead harbor, Feb. 4, 1897; Provincetown harbor, March 10, 1897; Neponset River, April 17, 1897; Lynn harbor, March 29, 1897; Manchester harbor, April 7, 1897; harbor at Plymouth, April 24, 1897; Weymouth Back River, March 15, 1897.

A survey of Broad Sound was made during the summer and fall of 1897, and a report and project were submitted on Nov. 19, 1897.

The survey of Merrimac River, from Lowell to New Hampshire State line, was made in November and December, and the notes are being plotted.

Preliminary examinations and reports at the following localities were also ordered:—

Gurnet Rock and other rocks at mouth of Plymouth harbor.

Duxbury beach, with view to protection of harbor.

Duxbury harbor, with view to widening and deepening improvement.

The approaches to the Cape Cod Ship canal.

The above examinations were made in 1896, and reports thereon have been submitted under the following dates: Gurnet Rock, Feb. 15, 1897; Duxbury beach, Feb. 15, 1897; Duxbury harbor, Feb. 15, 1897; the approaches to the Cape Cod Ship Channel, Feb. 16, 1897.

Very respectfully,

S. M. MANSFIELD,

Lieut.-Col., Corps of Engineers.

STATEMENT OF MAJ. D. W. LOCKWOOD, CORPS OF ENGINEERS,
U. S. A.

Abstract of work of river and harbor improvements in the State of Massachusetts by the United States government, under the direction of Maj. D. W. Lockwood, Corps of Engineers, U. S. A., for the fiscal year ending June 30, 1897.

Taunton River.

The work of dredging under the contract with the Hartford Dredging Company of Hartford, Conn., was completed. There

were 3,355 cubic yards of sand, clay and bowlders removed from near the mouth of Three Mile River, and the channel through the "Needles." With the exception of a small amount of dredging, the channel is now completed from Weir to the lower end of the "Needles."

Hyannis Harbor.

Work under the contract with the Hartford Dredging Company in force at the beginning of the fiscal year was completed during the month of August. There were 14,781 cubic yards of sand and mud removed, adding about 1.2 acres to the 15.5 foot anchorage protected by the breakwater.

A new contract was also made with the same company for continuing the dredging under the appropriation of 1896.

Nantucket Harbor.

A contract for about \$19,000 worth of work was entered into with Messrs. S. & E. S. Belden of Hartford, Conn., for continuing the construction of the jetties at the entrance to the harbor. Work under this contract was in progress at the close of the fiscal year, at which time the outer end of the east jetty had been strengthened and additional stone had been placed around the staff supporting the lantern at the end of the jetty, and 1,650 tons had been deposited in an extension of the west jetty.

In December, 1896, during an unusually severe storm, a breach was made through the "Haulover" beach, separating the ocean from the head of the harbor. The breach still remains open. No damage to the jetty channel appears to have resulted from this breach.

Edgartown Harbor.

Work under the contract with the Hartford Dredging Company, in force at the close of the last fiscal year, was commenced and completed during the month of July, 1896. There were 6,485 cubic yards of sand dredged from the Middle Ground Shoal, all of which has been removed to a depth of 10. feet at mean low tide, excepting a very small portion (about one-tenth of the area) on its eastern side.

Vineyard Haven Harbor.

A contract for about \$12,000 worth of work was entered into with Mr. William S. White of Rockland, Me., for construction of riprap sea wall and jetties along the low-water line in front of the bluff on the east side of the West Chop and for extending the sea wall on the East Chop about 100 feet to the westward.

Up to the close of the fiscal year 388 tons of stone had been placed in the work on the West Chop, completing about 270 feet of wall.

Woods Hole Harbor.

A contract was entered into with Mr. Charles W. Johnston of Philadelphia for dredging and removing bowlders from the strait leading from Woods Hole Harbor to Buzzards Bay, in pursuance of the project for the enlargement of the channel to a width of 300 feet and depth of 13 feet at mean low water.

At the request of the steamboat company carrying large numbers of passengers through this narrow channel during the summer months, operations under the contract were postponed until the close of the excursion season.

New Bedford Harbor.

The contract for dredging in the 18-foot channel in progress at the close of the last fiscal year was completed in July, 1896, completing the channel to a width of 200 feet.

A contract for about \$8,500 worth of dredging was entered into with the Hartford Dredging Company, for the commencement of an anchorage area 18 feet deep adjoining and to the northward of that reach of the main channel extending from New Bedford to Fairhaven. There were 68,887 cubic yards of mud and gravel removed, extending the deep water at the eastern end of the reach for a length of about 1,200 feet parallel to the channel and a width of 600 feet.

Canapitsit Channel.

Work under the contract for dredging in force at the close of the last fiscal year was commenced on the last day of the year.

Wrecks.

During the fiscal year the following wrecks were removed so as to no longer form an obstruction to navigation: —

Schooner "Enterprise," sunk in Vineyard Sound, one mile east south east of Buoy 11 A, eastern end of Norton Shoal.

An unknown wreck, about 5.5 miles south-east from Bishop and Clerk's Light.

Surveys.

The following surveys were made and reports thereon submitted to the Chief of Engineers and the Secretary of War: —

"Channel in New Bedford harbor, Mass., leading to the bridge between that city and Fairhaven, with a view to determining what

amount of dredging would be necessary to make the change in the draw in said bridge from the west to the east side of Fish Island practicable and advantageous." A channel 250 feet wide and 18 feet deep at mean low water is recommended, at an estimated cost of \$34,000.

"Mount Hope Bay and Fall River harbor, Mass." A channel 300 feet wide and 25 feet deep at mean low water, leading from the ocean to the wharves at Fall River, is recommended, at an estimated cost of \$175,411.94.

INSPECTIONS MADE BY THE BOARD DURING THE YEAR.

1896.

- Dec. 19. Dumping of snow and ice from West Boston bridge into Charles River.

1897.

- Jan. 29. Wharf of Standard Oil Company of New York on Chelsea Creek, in East Boston.
- Feb. 11. J. N. Cowin & Co.'s wharf on Mystic River, at mouth of Gravelly Brook, in Medford.
18. Beach at Point Allerton, in Hull, relative to removal of gravel.
24. Site of proposed wharf of John Stuart, at mouth of Sachem Brook, in Quincy.
26. Drain of Messrs. Swan & Woodberry, on beach in Beverly.
- March 4. Fort Point Channel, in front of site of Southern Union Station, relative to the complaint that the material being dumped into the channel at that point was causing an obstruction to navigation.
19. Revere Beach, relative to the removal of sand for use in the work of the Metropolitan Park Commission.
23. Steamship "Armenia," at New England docks, damaged by grounding on ledges in the main ship channel, while passing Bug Light in Boston harbor on March 22, 1897.
26. Beach at North Scituate, relative to removal of gravel.
31. Site of proposed bulkhead of W. A. Swain, on Nahant beach.
- April 5. Site of proposed dumping ground for material dredged under contract with the United States government, in Town River, Weymouth.
5. Beach in Hull, relative to removal of gravel.
13. Docks in Plymouth harbor, proposed to be filled under licenses from the Board.

April 22. New Bedford harbor, relative to obtaining material for use in filling solid a portion of the bridge between New Bedford and Fairhaven, authorized by chapter 368 of the Acts of 1883 and chapters 239 and 530 of the Acts of 1894.

May 6. Broad Canal, in Cambridge, on complaint concerning filling.

10. Devereux beach, in Marblehead, relative to the removal of gravel.

12. Dumping ground in Fall River harbor, relative to petition for authority to dump dredged material.

17. Site of proposed boat house of E. N. Cummings, in Lake Whalom.

19. Beach in Hull, relative to the removal of gravel.

20. Bridge of the Plum Island Turnpike Corporation, on Plum Island River, in Newbury.

21. Beach at North Scituate, relative to the removal of stone and gravel.

27. Beach at North Scituate, relative to alleged removal of material without authority from the Board.

28. Beach at Hough's Neck, in Quincy, relative to the removal of material.

June 2. Essex bridge, between Salem and Beverly.

3. Site of structures in Billington Sea, in Plymouth.

4. Site of proposed bridges across Monument River and Back River, in Bourne.

5. } Work done by the Commonwealth on the Province

6. } Lands, in Provincetown.

7. Location of boundary line between Wareham and Marion, as established by chapter 302 of the Acts of 1897.

11. Site of proposed dredging in Weymouth Fore River.

12-16. Boundary line between Gay Head and Chilmark, as established by chapter 323 of the Acts of 1897.

15. Stony Beach, in Hull, relative to the removal of gravel.

17. Bridge between New Bedford and Fairhaven, authorized by chapter 368 of the Acts of 1883 and chapters 239 and 530 of the Acts of 1894, and other work in New Bedford harbor.

18. Wreck in Vineyard Haven harbor.

18. } Site of proposed jetties at Menamsha Inlet, in Gay
19. } Head and Chilmark.

- June 24. } Jetties and methods used for maintaining and deep-
 25. } ening outlets of Salt Pond and Herring River, in
 } Harwich.
 26. Site of dredging in Charles River, near Boylston
 Street, in Cambridge.
 28. Location of wreck of schooner "Island Home," in
 Merrimac River, Newburyport.
- July 1. Location of dredging in Charles River.
 2. Site of proposed wharf of Cassius Hunt, in South
 Duxbury.
 8-10. Osterville, Cotuit and Hyannis harbors.
 9. Beaches at Nantasket, relative to the removal of
 gravel.
 20. Wharf of Geo. H. Wood Company, on Mystic River,
 in Charlestown.
 21. Filling being done at Albin M. Richard's wharf, on
 Mystic River, in Charlestown.
 21. Site of proposed dumping ground for material dredged
 in Essex River, under contract with the United
 States government.
- 21-22. }
 Aug. 5-7. } Work at Osterville and Cotuit harbors, required by
 13-17. } chapter 483 of the Acts of 1897.
 4. Charles River, near West Boston bridge; charge for
 gravel.
 12. "Haulover" Beach, at Wauwinet, Nantucket.
 19-21. Connecticut River, between Springfield and Holyoke,
 under chapter 82 of the Resolves of 1897; also
 protective works on said river, in Agawam.
 23. Work at the Southern Union Station, relative to a
 complaint that timber is being turned adrift and is
 dangerous to steamers in the harbor.
 24. Wharf in Winthrop harbor, now or formerly belonging
 to Linus M. Child, relative to a complaint that
 filling was being done without authority from the
 Board.
 26. Dock adjoining the park of the city of Boston on the
 south channel of Mystic River, near Chelsea bridge,
 relative to dumping material in said dock.
- Sept. 1-3. Work at Osterville and Cotuit harbors, required by
 chapter 483 of the Acts of 1897.
 11. Site of proposed wharf of Willard T. Sears, on
 Oyster Pond River, in Chatham.

- Sept. 13-18. Work at Osterville and Cotuit harbors, required by chapter 483 of the acts of 1897.
- 25. Beach in Hull, relative to the removal of gravel.
 - 27. Canal at East Cambridge, near wharf of Geo. H. Davenport, on complaint that shoaling has been caused.
 - 29. Site of the wreck of the steamship "Venetian," in Boston harbor.
- Oct. 8. Property of the heirs of B. K. Hough, in Gloucester, relative to proposed tide gate.
- 8. Connecticut River, between Springfield and Hartford, under chapter 82 of the Resolves of 1897.
 - 11. Sites of proposed structures in Lake Chaubunagungmaug, in Webster.
 - 13. Mystic Wharf and Storage Company's wharf on Mystic River, in Charlestown.
 - 15. Cooper's Pond, in Carver.
 - 19. Operation of the Babcock-Lary dredge in New Bedford harbor.
 - 22. Green Harbor, in Marshfield, with State Board of Health.
 - 23. Work done by the Commonwealth on the Province Lands, in Provincetown.
 - 25. Site of proposed marine railway of Read Brothers, on Taunton River, in Fall River.
 - 26. Stony Beach, in Hull, relative to alleged removal of material.
 - 27. Dumping ground for dredged material in New Bedford harbor.
 - 28-30. The method and location of dumping dredged material in New Bedford harbor.
 - 30. Protective works on the Connecticut River, at Agawam.
- Nov. 4. Bridge of the Boston, Revere Beach & Lynn Railroad Company, and adjoining flats, in Crystal Cove, Winthrop.
- 13. Beverly Shore, from Plum Cove to West Manchester.
 - 16. Site of proposed wharf of Smith & Mitchell, in Hull Bay.
 - 18. Canal at East Cambridge, near wharf of Geo. H. Davenport, relative to alleged shoaling.
 - 29. Location of proposed canal and other work at Patch's beach, in Beverly.

LICENSES GRANTED DURING THE YEAR.

- No.
1977. Petition of the West End Street Railway Company for license to dump snow and ice into tide waters. Granted Dec. 1, 1896.
 1978. Petition of the Union Freight Railroad Company for license to dump snow and ice into Charles River and Fort Point Channel. Granted Dec. 1, 1896.
 1979. Petition of the New Bedford Yacht Club for license to widen its wharf, on piles, in New Bedford harbor in the city of New Bedford. Granted Dec. 7, 1896.
 1980. Petition of Isaac P. T. Edmands and others for license to fill solid and build a culvert in Island End River in the city of Everett. Granted Dec. 8, 1896.
 1981. Petition of the Metropolitan Water Board for approval of plans for laying water pipes in Malden River, in the city of Malden, as authorized by chapter 488 of the Acts of 1895. Granted Dec. 21, 1896.
 1982. Petition of the city of Boston for license to dump snow and ice into tide waters. Granted Dec. 21, 1896.
 1983. Petition of the Tudor Company for license to extend Tudor wharf, on piles, on Charles River in the city of Boston. Granted Dec. 21, 1896.
 1984. Petition of J. Theodore Heard and Larkin T. Trull, trustees, for license to build a sea wall and fill solid in Charles River in the city of Boston. Granted Jan. 27, 1897.
 1985. Petition of George A. Minott and Mary A. Scammon, trustees, for license to build a sea wall and fill solid in Charles River in the city of Boston. Granted Jan. 27, 1897.
 1986. Petition of the Tudor Company for license to extend Tudor Wharf, on piles, on Charles River in the city of Boston. Granted Jan. 27, 1897.
 1987. Petition of Alice S. Weeks for license to build and maintain a stone and timber wharf in Marion harbor in the town of Marion. Granted Jan. 27, 1897.
 1988. Petition of the Lynn & Boston Railroad Company for license to dump snow and ice into Mystic River. Granted Jan. 27, 1897.
 1989. Petition of Helen Hamlin for license to build a stone wharf in Marion harbor in the town of Marion. Granted Feb. 16, 1897.

- Nos.
1990. Petition of J. A. Laforme, Winslow Warren and A. C. Reggio, trustees, for license to build a pile wharf on Fort Point Channel in the city of Boston. Granted Feb. 16, 1897.
 1991. Petition of the Standard Oil Company of New York for license to build a bulkhead and fill solid in Chelsea Creek at East Boston. Granted Feb. 16, 1897.
 1992. Petition of Amos S. Brown, S. Arthur Bubier and Barton E. Kingman, executors of the will of Mary G. Lamper, and Amos S. Brown, trustee, for license to fill a portion of Lamper's Mill Pond in the city of Lynn. Granted Feb. 24, 1897.
 1993. Petition of the trustees of the estate of John F. Randall for license to maintain a pile wharf in Boston harbor at East Boston, and to extend and widen said wharf on piles. Granted Feb. 26, 1897.
 1994. Petition of the Braintree & Weymouth Street Railway Company for license to lay and maintain suction, drain and discharge pipes in Weymouth Fore River in the town of Braintree. Granted March 5, 1897.
 1995. Petition of Elisha H. Tillson for license to construct and maintain a drain in Provincetown harbor in the town of Provincetown. Granted March 5, 1897.
 1996. Petition of Jerome C. Borden for license to build a sea wall and fill solid in Mount Hope Bay in the city of Fall River. Granted March 5, 1897.
 1997. Petition of John Stuart for license to build and maintain a pile wharf and float stages in Quincy Bay in the city of Quincy. Granted March 5, 1897.
 1998. Petition of the trustees of the Bay View Improvement Association for license to build a solid filled wharf in Buzzards Bay in the town of Dartmouth. Granted March 11, 1897.
 1999. Petition of Nancy E. Bliss for license to build and maintain a pile wharf and float stage in Pocasset harbor in the town of Bourne. Granted March 23, 1897.
 2000. Petition of the city of Cambridge for license to fill solid and change the shore line of Charles River from Boylston Street bridge to the Cambridge Hospital grounds in said city. Granted April 12, 1897.
 2001. Petition of William A. Swain for license to build a bulkhead and pile structure in Lynn harbor in the town of Nahant. Granted April 12, 1897.

- Nos.
2002. Petition of Joel F. Sheppard for license to build and maintain sea walls and fill solid in Weymouth Fore River in the town of Braintree. Granted April 13, 1897.
 2003. Petition of the Braintree & Weymouth Street Railway Company for license to build and maintain a sea wall and fill solid in Weymouth Fore River in the town of Braintree. Granted April 13, 1897.
 2004. Petition of William Minot, trustee, for license to fill solid, build a pile wharf, and to dredge, in Chelsea Creek at East Boston. Granted April 15, 1897.
 2005. Petition of Orlando E. Lewis for license to fill solid and maintain filling already done in Crystal Cove in the town of Winthrop. Granted April 15, 1897.
 2006. Petition of the heirs of J. R. Atwood Estate for license to build a bulkhead and fill solid a portion of a dock in Plymouth harbor in the town of Plymouth. Granted May 5, 1897.
 2007. Petition of James Millar & Co. for license to build a bulkhead and fill solid a portion of a dock in Plymouth harbor in the town of Plymouth. Granted May 5, 1897.
 2008. Petition of J. E. Lewis & Co. for license to extend a wharf belonging to the United States on Chelsea Creek in the city of Chelsea. Granted May 5, 1897.
 2009. Petition of the Walworth Manufacturing Company for license to widen its wharf in Boston harbor near the Reserved Channel at South Boston. Granted May 5, 1897.
 2010. Petition of the Worcester & Marlborough Street Railway Company for license to build retaining walls and fill solid in Lake Quinsigamond in the city of Worcester. Granted May 5, 1897.
 2011. Petition of the Boston Fire Brick and Clay Retort Manufacturing Company for license to widen a portion of its wharf, on piles, and fill solid, in Boston harbor near the Reserved Channel at South Boston. Granted May 26, 1897.
 2012. Petition of Fred McQuesten for license to fill solid and build two pile piers in Boston harbor at East Boston. Granted June 3, 1897.
 2013. Petition of the town of Bourne for approval of plans of bridges across Monument River and Back River in said town, as authorized by chapter 139 of the Acts of 1896. Granted June 9, 1897.

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- Nos.
2014. Petition of the Squantum Yacht Club for license to locate and maintain two float stages in Quincy Bay in the city of Quincy. Granted June 9, 1897.
 2015. Petition of Mary L. Hellier for license to build and maintain a wharf and float stage in Marion harbor in the town of Marion. Granted June 9, 1897.
 2016. Petition of the Young Men's Christian Association for license to build and maintain a boat and bath house in Lake Whalom in the town of Lunenburg. Granted June 9, 1897.
 2017. Petition of Ernest N. Cummings for license to build and maintain a boat house in Lake Whalom in the town of Leominster. Granted June 9, 1897.
 2018. Petition of Jackson R. Williams for license to build a pile wharf in Provincetown harbor in the town of Provincetown. Granted June 16, 1897.
 2019. Petition of the Plum Island Electric Street Railway Company for license to rebuild the bridges of the Plum Island Turnpike Corporation on Plum Island River and adjoining creeks in the town of Newbury. Granted June 16, 1897.
 2020. Petition of Joseph H. Burgess for license to build and maintain a pile wharf in Buzzards Bay in the town of Falmouth. Granted June 16, 1897.
 2021. Petition of the Marblehead Supply Company for license to build and maintain a dolphin in Marblehead harbor in the town of Marblehead. Granted June 16, 1897.
 2022. Petition of the city of Boston for license to rebuild a portion of the draw pier of Broadway bridge on Fort Point Channel in the city of Boston. Granted June 16, 1897.
 2023. Petition of the Board of County Commissioners of Bristol County for approval of plans for the portion of the bridge on Acushnet River between the city of New Bedford and town of Fairhaven lying between Fish Island and Pope's Island, with a draw therein, as authorized by chapter 368 of the Acts of 1893 and chapters 239 and 530 of the Acts of 1894. Granted June 24, 1897.
 2024. Petition of the West End Street Railway Company for license to build a bulkhead and fill solid in Dorchester Bay in the city of Boston. Granted June 24, 1897.
 2025. Petition of the Walworth Manufacturing Company for license to build a sea wall and fill solid in Boston harbor near the Reserved Channel at South Boston. Granted June 24, 1897.

- No.
2026. Petition of the Walworth Manufacturing Company for license to extend its wharf, on piles, in Boston harbor near the Reserved Channel at South Boston. Granted June 24, 1897.
2027. Petition of the Revere Yacht Club for license to build and maintain a pier and float stage in Massachusetts Bay in the town of Revere. Granted June 30, 1897.
2028. Petition of the trustees of the estate of John F. Randall for license to build two pile piers in extension of their wharf in Boston harbor at East Boston. Granted June 30, 1897.
2029. Petition of the trustees of the estate of Thomas B. Wales for license to build a sea wall and fill solid a portion of a dock at Harris wharf in Boston harbor in the city of Boston. Granted July 8, 1897.
2030. Petition of the trustees of the Municipal Real Estate Trust for license to build a sea wall and fill solid a portion of a dock at Harris wharf in Boston harbor in the city of Boston. Granted July 8, 1897.
2031. Petition of Cassius Hunt for license to build and maintain a pile pier and float stage in Duxbury Bay in the town of Duxbury. Granted July 8, 1897.
2032. Petition of the town of Fairhaven for approval of plans of a bridge and solid filling in the extension of Middle Street, on Acushnet River in said town, as authorized by chapter 503 of the Acts of 1896. Granted July 8, 1897.
2033. Petition of Loring W. Puffer for license to build and maintain a pile pier and float stage in Buzzards Bay at Onset Island in the town of Wareham. Granted July 8, 1897.
2034. Petition of the city of New Bedford for approval of plans of a dam between Great Quittacus Pond and Pocksha Pond, with an overflow and wasteway, in the towns of Middleborough and Lakeville, as authorized by chapter 345 of the Acts of 1894. Granted July 14, 1897.
2035. Petition of the Boston & Maine Railroad for license to fill flats, build a pile platform, and dredge, in Mystic River in the city of Somerville. Granted July 14, 1897.
2036. Petition of the Union Street Railway Company for license to build a temporary pile bridge between Pope's Island and Fish Island on Acushnet River in the city of New Bedford. Granted July 14, 1897.

- No.
- 2037. Petition of the town of Cohasset for license to build a dam and tide gates in Gulf River in said town. Granted July 14, 1897.
 - 2038. Petition of the Metropolitan Water Board for approval of plans of a bridge across Mystic River in the city of Medford, for the support of water pipes, as authorized by chapter 488 of the Acts of 1895. Granted July 20, 1897.
 - 2039. Petition of the city of Worcester for license to build a stone bridge at the causeway crossing Lake Quinsigamond in said city. Granted July 20, 1897.
 - 2040. Petition of the Boston Terminal Company for approval of plans for filling docks and wharves on Fort Point Channel in the city of Boston, as authorized by chapter 516 of the Acts of 1896. Granted Sept. 2, 1897.
 - 2041. Petition of the city of Boston for approval of plans of a sea wall and solid filling in Fort Point Channel in said city, as authorized by chapter 516 of the Acts of 1896. Granted Sept. 3, 1897.
 - 2042. Petition of the Roxbury Central Wharf for license to construct docks and wharves, fill lands and flats, and dredge, in South Bay in the city of Boston. Granted Sept. 3, 1897.
 - 2043. Petition of the city of Boston for license to build a bridge and sea wall, and fill solid, on Fort Point Channel in said city. Granted Sept. 7, 1897.
 - 2044. Petition of Charles M. Partelow for license to build and maintain a marine railway in Boston harbor at Point Shirley in the town of Winthrop. Granted Sept. 7, 1897.
 - 2045. Petition of the estate of George S. Harwood for license to rebuild a pile structure in Charles River adjoining Galen Street in the town of Watertown. Granted Sept. 7, 1897.
 - 2046. Petition of the People's Telephone Company for license to lay and maintain cables in Merrimac River in the city of Haverhill and town of Groveland. Granted Sept. 7, 1897.
 - 2047. Petition of the city of Boston for license to repair the middle and south piers of the North Ferry in Boston harbor at East Boston. Granted Sept. 7, 1897.
 - 2048. Petition of John Pridgeon, Jr., for license to build and maintain a pile pier in Vineyard Haven harbor in the town of Cottage City. Granted Sept. 8, 1897.
 - 2049. Petition of the Cambridge Gas Light Company for license to fill solid and maintain filling already done in Broad Canal in the city of Cambridge. Granted Sept. 8, 1897.

- Nos.
2050. Petition of Frederick Ayer for license to build a bulkhead and pile platform and fill solid in Broad Canal in the city of Cambridge. Granted Sept. 9, 1897.
2051. Petition of Frank L. Young for license to build a bulkhead and fill flats in Boston harbor at South Boston. Granted Sept. 15, 1897.
2052. Petition of Willard T. Sears for license to build and maintain a pile pier on Oyster Pond River in the town of Chatham. Granted Sept. 15, 1897.
2053. Petition of the West End Street Railway Company for license to widen its wharf, on piles, in South Bay in the city of Boston. Granted Sept. 15, 1897.
2054. Petition of J. Theodore Heard and Larkin T. Trull, trustees, for license to widen and extend their wharf, known as Winslow's wharf, on Charles River in the city of Boston. Granted Sept. 17, 1897.
2055. Petition of the heirs of Andrew G. Bradford for license to build and maintain a boat landing in Billington Sea in the town of Plymouth. Granted Sept. 17, 1897.
2056. Petition of William E. Baker for license to build and maintain a boat landing in Billington Sea in the town of Plymouth. Granted Sept. 17, 1897.
2057. Petition of the West End Street Railway Company for license to lay pipes in Charles River near its Harvard power station in the city of Cambridge. Granted Sept. 17, 1897.
2058. Petition of Benjamin Johnson for license to build a sea wall and pile platform and fill solid in Town River in the city of Quincy. Granted Sept. 17, 1897.
2061. Petition of the Fiske Wharf and Warehouse Company for license to widen Harris wharf, on piles, in Boston harbor in the city of Boston. Granted Sept. 24, 1897.
2062. Petition of the city of Cambridge for license to fill solid and change the north-easterly shore line of Charles River between Boylston Street and Western Avenue in said city. Granted Sept. 29, 1897.
2063. Petition of Steward & McDermott for license to build a temporary pile bridge between Fish Island and Pope's Island on Acushnet River in the city of New Bedford. Granted Sept. 29, 1897.
2064. Petition of C. A. Sawyer for license to build and maintain a pile and timber wharf and boat house in Lake Whalom in the town of Leominster. Granted Sept. 29, 1897.

- No.
2065. Petition of Augustus S. Messer for license to build a wharf, partly solid and partly on piles, in Woods Hole Great Harbor in the town of Falmouth. Granted Sept. 29, 1897.
2066. Petition of Augustus S. Messer for license to build a sea wall and fill solid in Woods Hole Little Harbor in the town of Falmouth. Granted Sept. 29, 1897.
2067. Petition of the Board of Metropolitan Park Commissioners for approval of plans for filling solid in Lower Mystic Lake in the city of Medford, as authorized by chapter 288 of the Acts of 1894. Granted Oct. 7, 1897.
2068. Petition of H. Porter Hall and C. E. Dresser for license to build and maintain a stone and timber wharf in Lake Whalom in the town of Lunenburg. Granted Oct. 7, 1897.
2069. Petition of Eugene V. R. Thayer for license to build and maintain a sewer in tide water in the city of Beverly. Granted Oct. 19, 1897.
2070. Petition of the city of Quincy for license to lay and maintain a water pipe in Town River in said city. Granted Oct. 19, 1897.
2071. Petition of Edgar S. Hill for license to build and maintain a stone wharf in Lake Chaubunagungamaug at Elliott Shore in the town of Webster. Granted Oct. 19, 1897.
2072. Petition of Edgar S. Hill and Arthur G. Pattison for license to build and maintain a stone and timber wharf in Lake Chaubunagungamaug at Point Breeze in the town of Webster. Granted Oct. 19, 1897.
2073. Petition of the Manomet Cranberry Company for license to build and maintain jetties in Fresh Pond in the town of Plymouth. Granted Nov. 2, 1897.
2074. Petition of F. T. Akin & Co. for license to extend their wharf on Acushnet River in the city of New Bedford. Granted Nov. 2, 1897.
2075. Petition of the Walworth Manufacturing Company for license to construct and maintain a dolphin in Boston harbor near the Reserved Channel at South Boston. Granted Nov. 2, 1897.
2076. Petition of the Mystic Wharf and Storage Company for license to extend and widen its wharf, on piles, on Mystic River in the city of Boston. Granted Nov. 4, 1897.
2077. Petition of Read Brothers for license to fill solid and build a marine railway in Taunton River in the city of Fall River. Granted Nov. 10, 1897.

- Noa.
2078. Petition of the Fitchburg Railroad Company for license to extend its pier known as Piers 6 and 7, at the Hoosac Tunnel Docks on Charles River in the city of Boston, to the harbor line established by chapter 479 of the Acts of 1897. Granted Nov. 16, 1897.
2079. Petition of the city of Fall River for license to construct coffer-dams and a flume in North and South Watuppa lakes in the city of Fall River and town of Westport. Granted Nov. 23, 1897.
2080. Petition of Horace S. Crowell for license to build and maintain pile structures and a float stage in Woods Hole Great Harbor in the town of Falmouth. Granted Nov. 23, 1897.
2081. Petition of the West End Street Railway Company for license to dump snow and ice into tide waters. Granted Nov. 23, 1897.
2082. Petition of the Union Freight Railroad Company for license to dump snow and ice into Charles River in the city of Boston. Granted Nov. 23, 1897.

MISCELLANEOUS PERMITS GRANTED DURING THE YEAR.

- EASTERN DREDGING COMPANY, to dump material dredged in Merri-mac River, under contract with the United States, on flats in said river above Rocks bridge. Granted Dec. 7, 1896.
- P. O. RIORDEN, to use a portion of the South Boston flats for storing sand, gravel and other material. Granted Dec. 7, 1896.
- BOSTON & MAINE RAILROAD, to publish notice, in the name of the Board, of the closing of Squam River in Gloucester to the passage of vessels through the draw in the Eastern Division bridge of said railroad for the purpose of constructing a new tower and foundation. Granted Dec. 15, 1896.
- SAMUEL A. WHITE, to remove gravel from Ocean Beach near Waveland station, in Hull. Granted Dec. 21, 1896.
- WILLIAM H. SYLVESTER, to remove gravel from the beach at Point Allerton, in Hull. Granted Feb. 24, 1897.
- FRANK C. HYDE, to remove gravel from Ocean Beach, in Hull. Granted Feb. 24, 1897.
- EMMA A. ABBOTT, to remove stones from the beach at Point Allerton, in Hull. Granted Feb. 24, 1897.
- E. WILLARD FROST, to remove gravel from Ocean Beach, in Hull. Granted Feb. 24, 1897.
- CENTRAL WHARF AND WET DOCK CORPORATION, to dump snow and ice into tide waters. Granted Feb. 26, 1897.

- JOSEPH L. BOARDMAN**, to remove gravel from Salter's beach, in Plymouth. Granted March 5, 1897.
- BAY STATE DREDGING COMPANY**, to dump material dredged in the channel leading to the wharf of the Boston and Nantasket Steamboat Company on flats between White Head and Strawberry Hill, in Hull. Granted March 5, 1897.
- EASTERN DREDGING COMPANY**, to dump material dredged in Malden River, under contract with the United States, on land and flats in a creek adjoining said river. Granted March 8, 1897.
- HARTFORD DREDGING COMPANY**, to dump material dredged in New Bedford harbor, under contract with the United States, in said harbor north of a line drawn due east from Egg Island and east of a line drawn due north from said island. Granted March 12, 1897.
- EDWARD J. CASHMAN**, to dredge material from the "middle ground," at Lobster rocks in Lynn harbor. Granted March 25, 1897.
- JOHN W. EARL**, to dredge material from the "middle ground," at Lobster rocks in Lynn harbor. Granted March 25, 1897.
- WILLIAM E. SHERRIFFS**, to remove sand and gravel from the beach between the Oregon House and Hotel Pemberton, in Hull. Granted April 6, 1897.
- LOUIS T. CUSHING**, to remove gravel from Collier beach, in Scituate. Granted April 6, 1897.
- TOWN OF SCITUATE**, to remove gravel from Collier beach, in Scituate. Granted April 6, 1897.
- TOWN OF SCITUATE**, to excavate at North Scituate beach, for the purpose of widening the road leading to the "Glades" in said town. Granted April 6, 1897.
- GEORGE C. CORCORAN**, to use for storage purposes 5,000 square feet of land on the easterly side of C Street, on the South Boston flats. Granted April 6, 1897.
- BAY STATE DREDGING COMPANY**, to dump material dredged in Weymouth Fore River, under contract with the United States, on flats situate on the northerly side of said river. Granted April 6, 1897.
- MARIA A. D'ORVILLE**, to remove gravel from Ocean beach near Kenberma station, in Hull. Granted April 13, 1897.
- JOHN J. O'BRIEN & Co.**, to remove sand from the Revere beach reservation, between mean high and low water marks, under contract with the Metropolitan Park Commissioners, for use in the approaches to the abutments at Revere Street. Granted April 15, 1897.

JOHN J. O'BRIEN & Co., to remove sand from the Revere beach reservation, between mean high and low water marks, under contract with the Metropolitan Park Commissioners, for use in the approaches to the abutments built in connection with the relocation of the Boston, Revere Beach and Lynn Railroad. Granted April 15, 1897.

WILLIAM T. EATON, to remove sand from the Revere beach reservation, under contract with the Metropolitan Park Commissioners, for use in connection with the erection of the bathing establishment, shelters and subways on said reservation. Granted April 15, 1897.

JAMES C. CHURCH, to remove gravel from Ocean beach near Kenberma station, in Hull. Granted April 15, 1897.

BOSTON TERMINAL COMPANY, to build a temporary pile trestle on Fort Point Channel in the city of Boston, for the purpose of carrying out the work authorized by chapter 516 of the Acts of 1896. Granted April 26, 1897.

CITY OF CAMBRIDGE, to dredge flats adjoining the outlet of the Bridge Street sewer on Charles River, and to dump the dredged material east of a line drawn from Egg Rock to Minot's Light. Granted April 29, 1897.

OLIVER S. SANFORD and O. S. SANDERS, to dredge material from their flats in Dorchester Bay. Granted April 29, 1897.

NANTASKET CHUTE COMPANY, to lay a water pipe in tide water at Nantasket Beach, in Hull. Granted April 29, 1897.

WILLIAM P. CLYDE & Co., to dredge in Shirley Gut, Boston harbor, between Point Shirley and Deer Island. Granted May 5, 1897.

JOHN W. EARL, to dredge material from the "hump sands" near the mouth of the Merrimac River. Granted May 5, 1897.

PETER McCONARTY, to use for storage purposes a portion of the Commonwealth's land on the South Boston flats. Granted May 5, 1897.

WILLIAM J. GOLDTHWAIT, to remove sand and gravel from Devereux beach, in Marblehead. Granted May 11, 1897.

JOHN T. KALER, to remove gravel from the beach in Hull Bay, opposite his land on Spring Street, in Hull. Granted May 20, 1897.

CHARLES S. GOODING, to remove gravel from Ocean Beach near Kenberma station, in Hull. Granted May 20, 1897.

STEWART & McDERMOTT, to dredge material in Acushnet River for use in filling a portion of the highway bridge under construction between New Bedford and Fairhaven. Granted May 20, 1897.

- JOSEPH A. BOWEN**, to dump dredged material on flats in Coles River, in Swansea. Granted May 24, 1897.
- BAY STATE DREDGING COMPANY**, to dredge material from Charles River, between North Harvard Street bridge and a line drawn across said river 4,000 feet up stream from said bridge. Granted May 26, 1897.
- JOHN V. SCOTT**, to remove gravel from Manet beach at Hough's Neck, in Quincy. Granted June 2, 1897.
- TOWN OF DUXBURY**, to remove sand and gravel from Duxbury beach opposite Cut Island in said town. Granted June 10, 1897.
- JOHN T. KALER**, to remove gravel from the beach lying between Stony beach and Point Allerton, in Hull. Granted June 10, 1897.
- ALBERT L. JEWELL**, to remove sand and gravel from the beach lying between Atlantic Hill and Hotel Nantasket, in Hull. Granted June 15, 1897.
- EMMA E. HOBART**, to remove gravel from Ocean beach between Kenberma and Bayside stations, in Hull. Granted June 15, 1897.
- TOWN OF SCITUATE**, to remove gravel from North Scituate beach. Granted June 23, 1897.
- CUNNINGHAM IRON COMPANY**, to change the location of the railroad track across B Street, in South Boston. Granted June 25, 1897.
- BAY STATE DREDGING COMPANY**, to dredge material from Charles River between North Harvard Street bridge and a line across said river 1,000 feet down stream from said bridge. Granted June 28, 1897.
- WILLIAM B. BIRD**, to remove gravel from the beach between Crow Point and Jarvis Avenue, in Hingham. Granted June 29, 1897.
- NEW ENGLAND RAILROAD COMPANY**, to connect a drain pipe from its freight house on B Street with the Commonwealth's sewer in Fargo Street, on the South Boston flats. Granted July 1, 1897.
- EASTERN DREDGING COMPANY**, to dredge material from Charles River, between a line drawn across said river at a point 400 feet above North Harvard Street bridge and a line across said river 2,000 feet up stream from said bridge. Granted July 6, 1897.
- CITY OF BOSTON**, to lay water pipes in B Street from Danby Street to Congress Street; in E Street from Danby to Congress Street; and in Danby Street between B and E streets, on the South Boston flats. Granted July 12, 1897.

GEORGE G. CROCKER and others, trustees, and MARY G. FISK, to dredge material from their flats on the Cambridge side of the channel in Charles River, near West Boston bridge. Granted July 20, 1897.

PERKINS & WHITE, to dump material dredged in Town River, under contract with the United States, on land and flats of William A. Gavin, in the city of Quincy. Granted July 20, 1897.

EASTERN DREDGING COMPANY, to dredge material from Charles River, between a line drawn across said river from the south-westerly corner of Wellington's wharf and a line drawn across said river from the intersection of the southerly line of Stiles Street and the high-water line. Granted July 30, 1897.

PERKINS & WHITE, to dump material dredged in Town River, under contract with the United States, on land and flats of Benjamin Johnson, in the city of Quincy. Granted Aug. 5, 1897.

GEORGE C. CORCORAN, to use for storage purposes a portion of the Commonwealth's land on the easterly side of C Street on the South Boston flats. Granted Sept. 3, 1897.

NEW ENGLAND TELEPHONE AND TELEGRAPH COMPANY, to place and maintain eight poles for the support of wires on land of the Commonwealth north of Congress Street on the South Boston flats. Granted Sept. 7, 1897.

COLUMBIA DREDGING COMPANY, to dump dredged material in New Bedford harbor, north of a line drawn due east from Egg Island and east of a line drawn due north from said island. Granted Sept. 8, 1897.

KATE A. KNOWLTON, to remove stones from the beach bordering on Nantasket Roads, in Hull. Granted Sept. 27, 1897.

EMMA A. ABBOTT, to remove stones and gravel from the beach at Point Allerton, in Hull. Granted Oct. 7, 1897.

EASTERN DREDGING COMPANY, to dump material dredged in Essex River, under contract with the United States, on certain flats in said river. Granted Oct. 12, 1897.

ESTATE OF TIMOTHY A. NEWHALL, to dredge from their flats in Lynn harbor. Granted Oct. 13, 1897.

BAY STATE DREDGING COMPANY, to dump material dredged in Mystic River, under contract with the United States, in certain creeks adjoining said river. Granted Oct. 28, 1897.

BAY STATE DREDGING COMPANY, to dump material dredged in Mystic River, under contract with the United States, on certain flats in said river. Granted Nov. 2, 1897.

OLIVER S. SANFORD and O. S. SANDERS, to dredge material from their flats in Dorchester Bay. Granted Nov. 5, 1897.

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W. H. READ and H. R. READ, to dump material dredged in Taunton River for the construction of a marine railway in Fall River, on flats in Coles River lying north-west of Mattapoissett Rock, in Swansea. Granted Nov. 23, 1897.

HARBOR COMPENSATION FUND.

There was paid into the treasury of the Commonwealth during the year, under sections 14 and 16 of Chapter 19, Public Statutes, and chapter 146, Acts of 1897, in payment for tide water displaced by work done under licenses granted by the Board, and for rights and privileges granted in tide waters and great ponds, the sum of \$3,813.40, which was credited to the harbor compensation fund for Boston harbor. The amount in this fund on Nov. 30, 1897, was \$234,933.61. The income from this fund on the same date was \$14,477.13.

SALARIES OF COMMISSIONERS.

The attention of the Legislature is again invited to the inadequate compensation of the Board, in the belief that the increased work and responsibility of the commission will receive due consideration.

The foregoing report is respectfully submitted.

WOODWARD EMERY,
CHARLES H. HOWLAND,
CLINTON WHITE,

Commissioners.

DECEMBER 1, 1897.

APPENDIX.

APPENDIX.

[A.]

[See page 24 of this report *ante*.]

REPORT OF THE ENGINEER ON OSTERVILLE AND COTUIT HARBORS.

Boston, Nov. 13, 1897.

Board of Harbor and Land Commissioners.

GENTLEMEN:—In accordance with your instructions, I have made an examination and survey of Osterville and Cotuit harbors and the strip of land lying between Osterville Bay and Vineyard Sound, between Wianno Beach and the mouth of Sepuit River, and have obtained such information as I could in relation to the construction of a channel between the South Bay, so called, and the Sound.

Chapter 483 of the Acts of 1897, which authorizes this investigation, is based on the petition of Nathan E. West and others to the Legislature, and the object is to open a passageway for small yachts and other boats from the South Bay into the Sound, in order to avoid the long and difficult trip from the North Bay through the Narrows and Cotuit Bay into the Sound, making a saving of two to three miles on a trip.

The Cotuit and Osterville harbors consist of a series of basins located between the villages of Cotuit and Osterville on the south shore of the town of Barnstable, opening into the Sound by what is known as Cotuit entrance. This entrance lies between Codman's Point, which projects easterly from Cotuit highland, and the westerly end of a ridge or sand beach known as Dead Neck Beach, which extends westerly from the main land at Osterville. Between these two points lies Sampson's or Daniels' Island, which divides the entrance into two channels, known as the Main Channel and the Old or Eastern Channel. After passing Sampson's Island the Main Channel divides into two others, known as the Middle Channel and the Western or Rushy Marsh Channel. Between these lies a small patch of marsh surrounded by a large shoal, and known as Gull Island. Inside of this entrance the first bay is called Cotuit Bay, with an area of about 295 acres, forming the

harbor of Cotuit. Lying north-easterly of this is the North Bay, with an area of about 326 acres, the easterly end of which forms the western harbor of the village of Osterville. This is connected with Cotuit Bay by the Narrows, so called, having an area of about 127 acres. Lying south of North Bay and east of Cotuit Bay is the South Bay, with an area of about 334 acres, which it is proposed to make into a new harbor for the village of Osterville by means of a cut through the narrow beach which separates it from the Sound. This South Bay is connected with the North Bay by a short channel, and with Cotuit Bay by the Sepuit River, which has an area of about 44 acres, with a general width of about 300 feet, and separated from the Sound by the narrow sand ridge called Dead Neck Beach. Lying north of and connected with the North Bay is another small bay, known as Prince's Cove or Mill River, which has an area of about 60 acres.

The general depth of water which can be utilized for sailing through these various bays and their connection is from 4 to 6 feet at low water, though at places in the Cotuit and North bays there is a much greater depth. The upper part of Sepuit River and the southerly portion of the South Bay are quite shoal, and at present are not navigable, even for light draft boats, except at or near high water.

In 1876 a petition for authority to construct a similar cut through the beach "between the necks" was made to the Legislature by Orville D. Lovell and 113 others, in which they state that it would greatly advance their business and convenience, and that this strip of beach was gradually washing away, and would within a few years leave such a passage by the natural action of the waves.

Thomas Chatfield and 43 others, largely residents of the village of Cotuit, presented a petition remonstrating against the petition of Mr. Lovell, stating that in their opinion the cutting of such a channel would prove an injury to the harbor of Cotuit; that it would lessen the current on the ebb tide, by which the Cotuit channel was kept open over the bar; and that it would make an island of Dead Neck, so called, and destroy the means of getting teams onto Grand Island, so called, which had lately been purchased by New York parties, who intended to erect buildings for summer residences there. The petition also stated that between twenty-five and thirty vessels winter at Cotuit annually, and required all the water then on the bar at average tides to pass in and out.

These petitions were referred to the committee on harbors, and the petitioners, on the recommendation of that committee, were given leave to withdraw.

While the petitions were being considered, the Harbor Commissioners, at the request of the committee on harbors, directed their engineers, Prof. Henry Mitchell and D. Koppmann, to make a general examination of the locality and to report thereon. In their report they state that the storm seas are washing away the headlands along the coast in this vicinity and strewing the sands into and across little flords, which are characteristic features in the physical geography of this part of the country. Their visit to the locality in March, 1876, was shortly after a violent equinoctial gale. They found that the bluff about $1\frac{1}{4}$ miles eastward of the site of the proposed cut, according to the statements of the occupant of the house at this point, had fallen back about 7 feet during that gale, the bluff at this point being about 18 feet above sea level. At the time of their visit little or no trace of this material could be distinguished on the beach. From the same parties it was learned that the material was swept to the westward as it fell. The storm began from the north-east, but veered to the south-west before it reached its greatest fury. All along the bluff, toward the site of the proposed cut, they found freshly fallen trees lying on the face of the bluff, and from the appearance of these trees and of others still standing, they judged that the bluff had fallen back at least 6 feet in the recent storm. Not only did they notice none of the material on the beach, but the parties living there stated that the width and elevation of the beach had not been noticeably changed. On the beach where the proposed cut was to be made they could discover no marked effects of the storm, with the exception of traces of trifling runs of water over it; and they state that "this isthmus, as well as we could observe, is a dry bar created by the sea, and probably falling back on the bay as the uplands on either side crumble away." They found that the bluffs to the westward of the proposed cut showed traces of great slides during the recent gale, but these slides generally did not extend to the crest of the bluff. They go on to state that "Dead Neck is slowly advancing to the south-westward, probably with material supplied by the wear of the bluffs, upon which we have commented, the point having gained 12 acres within the memory of one of the two owners, and 20, as estimated by the other. . . . The west shore of Cotuit entrance is mostly upland, presenting here and there bluffs facing the sea. The recent storm has torn the lower bluff of Cotuit Highlands (which is about 25 feet high), precipitating several living trees of considerable size. Stumps of trees are also seen beyond the bluff, betraying the effects of the storms of past years. The islands, also, of Cotuit entrance are being washed away, although the marshes, of which they are in part composed, resist obstinately

the action of the sea." In regard to the Cotuit entrances, they state: "Leaving Cotuit port, the channel is divided into two waterways by Sampson's and Russia Marsh islands; and these two divisions, although they again approach each other slightly, cross the bar separately. They no sooner escape from the confinement of the inlet than they begin to shoal up, from 10 or 12 feet in the Narrows, to 3 or 4 feet before you get 500 feet beyond them."

No surveys were made at this time, the only observations being those which could be taken during a short visit to and inquiries made at the locality, together with such information as could be obtained from the printed coast survey charts.

The information which I have sought to obtain through my surveys and investigations was to determine to what extent the volume and velocity of the tidal flow through the Cotuit entrances would be affected, providing such a cut should be made through the beach from the South Bay, as would create a navigable channel for boats drawing in the neighborhood of three or four feet.

I first obtained from the U. S. Coast Survey Office at Washington copies of all their surveys of this locality up to the present time. They sent me three plans of soundings, one made in 1854, one in 1855 and 1856, and one in 1888, the survey of 1888 being the only one in which the soundings were taken in the bays, but even at this time none were taken in the South Bay. They also sent copies of the plans of their surveys of the topography, one made in 1846, and the other in 1890. This last survey I have used as the basis for the plan which I have made.

In starting the work, I first established tide gauges, one near the entrance of Cotuit Harbor on the wharf of Mr. Morse, just south of Cotuit Highlands; another on the wharf of Mr. Scoville, about a mile east of the proposed cut; and a third at the bridge between the village of Osterville and Grand Island. Four subsidiary gauges were established, one at each end of the Narrows between the North Bay and Cotuit Bay; one at the head of Eel River, near the proposed cut; and the fourth at the south-westerly corner of the South Bay, near the head of Sepuit River. Soundings were taken all over the South Bay, Eel River, Sepuit River, the Narrows, and from Cotuit Bay out through the entrances and to a line beyond the bar. Observations were made of high and low water for more than a month at each of the three main gauges, and simultaneous readings were taken at all of the gauges on two different occasions for a full tide.

A system of triangulation was extended from two stations of the coast survey over the area under examination. Based on this

the shore line of Mill River, Eel River and a portion of the North and South Bay near the Grand Island bridge, and of the South Bay near the head of Sepuit River, was surveyed and mapped to supplement the copies of the coast survey maps, which we obtained from Washington. The velocity of the flood and ebb currents was measured at three stations, — one in the Sound about 1,000 feet south from the shore of Dead Neck; one in the old outlet of Cotuit harbor, between the point of Dead Neck Beach and Sampson's Island; and the other in the present outlet, between Sampson's Island and Codman's Point. From the results of these surveys and observations we find that the mean range of the tide in the Sound at this locality is nearly three feet; the area of the various bays, mean range of the tide and tidal volume of each are given in the following table: —

	Area. Square Feet.	Mean Range of Tide. Feet.	Mean Tidal Volume. Cubic Feet.
Cotuit Bay, ...	12,832,500	2.85	36,572,625
The Narrows, ...	5,525,000	2.7	14,917,500
North Bay, ...	14,225,000	2.6	36,985,000
Mill River, ...	2,581,500	2.0	5,163,000
South Bay, ...	14,570,000	2.14	31,179,800
Sepuit River, ...	1,937,500	2.7	5,231,250

The depth of water at the present time over the bar at Cotuit entrance is about $3\frac{1}{2}$ feet at mean low water, which is substantially the depth testified to at the hearings at Osterville and Cotuit.

An examination of the cross-sections of the beach on either side of Dead Neck shows that from the crest of the ridge down to nearly 3 feet below mean low water the slope of the outside beach is quite regular and rapid, averaging about 15 to 1. Below this the bottom is very flat, the depths of 3 feet below mean low water being found from 200 to 300 feet beyond the high-water mark; 4 feet, from 600 to 800 feet; and 5 feet, from 800 to 1,000 feet beyond the same mark, the water deepening most rapidly opposite the head of Sepuit River.

The bottom of the Sound just outside of the bluff of Dead Neck, and opposite Sampson's and Gull islands, is covered with boulders generally 6 inches to a foot or more in diameter, indicat-

ing that these areas were originally portions of the upland which have been washed away. There appears to be no eel grass growing in these localities, but the bottom is very flat, with the boulders lying practically on the surface.

I have examined the shore of the Sound from the East Bay at Osterville to Popponessett entrance, a distance of about 5 miles. All the bluffs along this distance show the effects of having caved down and been washed away by the sea, and, wherever they are unprotected by artificial structures, are still being worn away. The protected portions extend about 1,500 feet north-east and about 3,000 feet south-west from the wharf near the Cotocheset House, and for a distance of about 2,000 feet in front of the premises of Mr. Morse and others at Cotuit.

The method which has been adopted for protecting the bluffs in this vicinity consists of building a wooden bulkhead at the foot of the bank at about extreme high-water mark, consisting of heavy stakes driven by hammers, with 2-inch plank spiked on the inner faces of the stakes. Extending from these and at right angles thereto are similar bulkheads or jetties which extend down to or below low-water mark, and from 20 to 50 feet apart. The top edges of the plank are left about a foot above the surface of the beach. These jetties tend to break up the waves striking on the beach and prevent them from undermining the bulkhead and from drifting the material along the shore. The tendency of the sand and shingle to drift along the shore is shown wherever these jetties are placed, by the sand being piled up on the side of the jetties from which the sand is coming and being cut away from the opposite side. The bulkhead along the high-water line intercepts the material which has caved down from the bank by the action of the frost and surface water, and prevents it being carried out into the sea, where it would be drifted along the beach. This construction is comparatively light and is often injured by the heavy seas and requires constant repairs, but has proved quite effective in stopping the wear of the bluffs. The bluffs of Dead Neck are still unprotected. Portions of the westerly end of Dead Neck Beach and the easterly ends of Popponessett and East Bay beaches are growing. The accumulations of sand collected by the protective works which have been built show that the sand has apparently been drifting along the shore from west to east, while the growth of the Popponessett and East Bay beaches is an additional indication that the drift of the sand is in the same direction. The growth of the westerly end of Dead Neck Beach would seem to indicate that at some point between Dead Neck bluff and the Cotocheset House the drift of the sand changes, and along Dead Neck Beach and bluffs

the material travels from east to west. In studying the question of the wear of the shore, I have compared the topographical sheets of the coast survey, made in 1846 and 1890. This comparison shows that between the break which was made in the Popponessett Beach about 1886 or 1887, and the present entrance to the East Bay (a distance of about 5 miles) the bluffs and beaches have worn away in some places and advanced in others, so that the areas within the high-water lines of 1890 show a loss of 110 acres and an increase of 58 acres in these forty-four years. The increase is principally at the ends of Popponessett, Dead Neck and East Bay beaches, while the decrease is mainly along the high upland bluffs of glacial drift and at the two islands in the Cotuit entrance. Portions of the Popponessett and East Bay beaches have been driven in toward the main land without material change in their size, while other portions of Popponessett Beach and a portion of the Dead Neck Beach have been materially reduced in width. One of the islands in the Cotuit entrance has been practically all washed away. The whole of the sand ridge which formed the main portion of it has been washed away to below the level of low water, leaving only a small circular area of marsh, about 30 or 40 feet in diameter, whose surface is a little above the level of low water.

As before stated, no soundings were taken by the coast survey previous to 1888 within the Cotuit entrance and bays, and the 1888 surveys were too general to be of much value in comparing with our more detailed survey.

I learned from some of the boatmen and others that within their remembrance there was an area of deep water lying between the end of Popponessett Beach and Gull Island, where vessels could lie at anchor afloat at all stages of the tide. They stated that this had so filled up that it would be dangerous for a vessel to anchor there now. By comparing the survey which I made in July, 1893, in connection with the investigation to locate the boundary line between Mashpee and Barnstable through Popponessett Bay, with our recent surveys, I find that since 1893 the westerly point of the Gull Island shoal has grown out into the Rushy Marsh channel, reducing its width and depth; also that the channel from Popponessett Bay has been forced farther to the north-east, and is now partially within what was in 1893 the channel from Cotuit Bay; also that a shoal has grown out from the main land opposite the north-westerly point of the Gull Island shoal, so that the Rushy Marsh channel is now only 60 to 70 feet wide for a distance of about 300 feet at this place. The sand along the shore between Popponessett Beach and Codman's or Bluff Point appears to be drifting from the

south-west to the north-east, as testified to by Mr. Morse at the hearing at Cotuit, and as shown by the piling up of the sand against the jetties which have been built in front of his premises, and along the shore south-westerly from him. As this sand reaches the end of Codman's or Bluff Point, the ebb current evidently takes a portion of it and pushes it back toward the sea, making the hook-shaped shoal extending from Codman's Point southerly and south-westerly, substantially parallel with the north-westerly side of Sampson's or Daniels' Island, the main entrance to the harbor lying between the island and this shoal. The balance of the material has probably been carried along by the flood tide and spread over the outer or southerly portion of the Cotuit Bay, but I have not been able to find any direct evidence of this. The material from the southerly end of Sampson's Island appears to have been driven round to the north-westerly point of the island, and mainly deposited there in a long shoal which extends westerly and south-westerly therefrom. These two shoals appear to be ridges built out into a deep depression which formerly existed between the main land and Daniels' and Gull islands, and apparently are tending to gradually fill it up, leaving only a small channel through it for the passage of tide water in and out of Cotuit Bay.

The investigations which I have made tend to show that Daniels' Island and Gull Island are the remains of two points of a large island of glacial drift, which covered the territory lying south-east of the existing islands, the basin lying between it and the main land being of considerable depth, and similar to the present Cotuit Bay. By the wearing away of the island, material has been supplied for building the shoals in the vicinity; and now the main land, having lost the protection from the wind and waves which was afforded by the island, is wearing away, the point south-west of Mr. Morse's estate having lost over 8 acres since 1846; and the material so furnished, together with material from the remains of the island, is gradually filling up the basin, and it seems to me that it is only a question of a very few years before the Rushy Marsh channel will be closed at the narrow gut between the north-westerly point of Gull Island shoal and the main land, and the only available entrance to Cotuit will be through what is now known as the Middle channel between Gull Island and Daniels' Island.

In the petition of Orville D. Lovell and others to the Legislature in 1876 for authority to excavate a channel from Eel River into the Sound, they stated that the beach at this point was washing gradually away and would within a few years leave such a passage

by the natural action of the waves. In commenting on this, the engineers of the Board in 1876 state that "this isthmus, as well as we could observe, is a dry bar created by the sea and probably falling back on the bay as the uplands on either side crumble away." By a comparison of the coast survey plans of 1846 and 1890, I find that the inner edge of the ridge or sand bar on both sides of Dead Neck has not moved appreciably, while the high-water line on the outer side has worn away very much, a comparison of the plans showing a loss of about 50 to 60 feet in width opposite Eel River and about 40 feet on the west of Dead Neck. From this evidence it would seem that there is some ground to expect that a cut would be made here at some time by the operations of nature; but at the rate the beach has worn away in the last forty-four years, it will take considerable time yet to accomplish it, and even if such a break should occur, it might close again in the same manner as the break through Popponesset Beach closed within a few years after it occurred, unless some means were taken to protect and maintain it by building jetties or similar structures.

In studying the question of a new entrance for Osterville harbor through the beach into the South Bay, which will not injure the harbor of Cotuit, the following conditions are to be satisfied. The amount of tidal volume passing in and out of the new entrance shall not reduce the volume now passing in and out of Cotuit entrance, and the cut shall be of sufficient size to enable yachts and boats to pass in and out readily. From the results of our tidal observations, we find that the rise and fall of the tide in the South and North bays is not as great as in the Cotuit Bay. If an entrance can be made of such a size as to allow an amount of tide water to enter and leave the South Bay through it, which, together with the tide water which now enters and leaves it through the Cotuit Bay, will give as great a range of tide there as now occurs in the Cotuit Bay, the Cotuit entrance would still have its full volume of tidal flow, the new entrance taking only the volume given by the increased tidal capacity caused by the direct connection with the Sound. After making many inquiries and calculations, I have finally fixed on a channel with a maximum width of 175 feet and a depth of 3 feet at mean low water, with jetties at its mouth extending to a depth of 4 feet at mean low water in the Sound; the width of 175 feet to extend through the beach from low water on the outside to the edge of marsh on the inside. This part should be protected by timber bulkheads. The jetties on the outside to gradually diverge from the low-water line, so as to be 200 feet apart at their outer ends. The channel in the bay to be excavated 225 feet wide on the bottom, and to extend from the edge of the

marsh at the end of the cut through the beach about 2,000 feet into the bay, in a north-easterly direction, to where there is at present a depth of 3 feet at mean low water. This channel, with tidal velocities on an average tide equal to those which were measured in the main channel of the Cotuit entrance, would allow 13,000,000 cubic feet to pass through it on an average tide. The increase in the tidal volume, which can be obtained by giving freer access between the South Bay and the Sound, is 10,300,000 cubic feet for the South Bay and 1,500,000 cubic feet for the North Bay. The changes in the other bays will probably be too small to seriously affect the result, the tendency being to increase the tidal volume in each case. If such a cut is made and the sides thoroughly protected, I think that the effect on the entrance at Cotuit will be so immaterial as not to influence navigation, though, at the same time, I wish to call attention to the statement which I have previously made, that the Cotuit entrance is liable in a very short time to have its available navigable depth materially reduced from existing causes.

In considering the best location for the proposed cut, two places have suggested themselves: One through the beach at the head of Eel River, "Between the Necks" so called, which is the place described in the petition to the Legislature, and the other through the beach on the westerly side of Dead Neck near the head of Sepuit River. As before stated, the beach at each place slopes down rapidly nearly to the level of 3 feet below low water. Beyond this slope the increase in depth is a little more rapid at the west side of Dead Neck than at the Eel River location. The amount of excavation required through the beach and to the 3-foot curve on the outside beach is about the same in either case. The total excavation required is 18,000 cubic yards greater on the west side of Dead Neck than on the Eel River side. On the west side the bay is open and the wind has a free sweep across it, especially from the southwest, which is the prevailing summer wind. The Eel River is very narrow, there being a distance of only 200 to 300 feet between the trees lining the banks on either side; these trees intercept the wind to such an extent that sail-boats would have to be rowed or poled through it most of the time, even in windy weather, while on the west side of Dead Neck, the wind being comparatively unobstructed, they could sail in and out freely. The amount of jetty work would not be materially different in either location, — probably a little less on the west side. Taking everything into consideration, it seems to me that the best location for the cut is a section of the beach owned by the proprietors of Grand Island, and situated just west of Dead Neck. If this location is

adopted, it will also do away with any question of damages to be claimed by the owner of Dead Neck on account of cutting off his access to the same from the main land.

The methods to be adopted in excavating the proposed channel and in providing for its maintenance require much study and consideration. Any simple excavation through the beach, with the expectation that the tidal current will scour out a navigable channel, will probably result in failure, as the material drifting along the shore and scoured out by the current would undoubtedly form bars around the mouth, which would render it useless for purposes of navigation, even if it did not completely close it. Owing to the small rise and fall of the tide, the volume of water which will pass in and out of such an entrance will be comparatively small; and in a channel of sufficient size for the purposes of navigation, the velocity of the currents must necessarily be small, so that we cannot rely on the currents—whose maximum velocity would probably never exceed 3 feet per second and whose average maximum velocity will probably be less than 2 feet per second—to do much more than maintain a channel which has been artificially excavated. In order to direct this current so that it shall disperse material which may be drifted across the channel along the shore and also as far as possible to intercept such material and prevent its entering the channel, it will be necessary to build jetties extending for a considerable distance out into the Sound on each side of the channel; these should extend out to where the depth of water is such that the bottom is not materially disturbed by the waves; in this case I think that it would be sufficient to extend the jetties about 500 feet from high-water mark to where the depth is not less than 4 feet at mean low water. These should be built of stone, to be permanent; but, from the success which has been had with timber jetties along the coast to the eastward of this locality, and as the best dimensions for the proposed channel may be shown by experience to be somewhat different from those first adopted, I recommend that the jetties here should be built at first of piles and timber, with the expectation that when they are weakened or destroyed by the action of decay and the worms they can be replaced by stone, and the permanent work can probably be done more cheaply then than at the present time, as the vessels bringing the stone will at that time have the advantage of the deep water of the new channel and the protection afforded by the timber jetties. A timber jetty will probably last at least four or five years, which will doubtless be long enough to determine whether the new entrance is of sufficient value to warrant the additional expenditure for a more permanent construction.

80 HARBOR AND LAND COMMISSIONERS. [Jan.

I have made the following estimates of the cost of construction of such a channel, with the necessary timber jetties to protect the sides of the cut through the beach and to protect the entrance from the drift of sand along the beach.

Estimate for Channel 175 Feet Wide.

550 oak piles, 12 to 20 feet long, in place, ...	\$2,240 00
67 M spruce timber, at \$18, ...	1,206 00
6,000 pounds bolts and nails, at 3 cents, ...	180 00
Labor, ...	1,500 00
	\$5,126 00
Plus 10 per cent., ...	513 00
	\$5,639 00

Excavation:—

50,000 cubic yards, at 30 cents, ...	\$15,000 00
Plus 10 per cent., ...	1,500 00
	16,500 00
	\$22,139 00

The depth of this channel was fixed by the depth of water required for boats used in this locality, and the width is the maximum width to which a channel of this depth could be excavated without liability to injure the Cotuit entrance. If a channel of less width was excavated, the volume of water which could pass in and out with each tide would be less, and no disturbance to the currents in Cotuit harbor would result therefrom. The boats which are used in this locality are small, and, in order to reduce the expense of the work, I would suggest that the width of the channel to be constructed should be fixed at 100 feet, which would enable the boats to pass in and out freely, except when the wind is dead ahead.

In accordance with this recommendation, I have made the following estimate for a channel 100 feet wide, the other conditions being the same as those in the first estimate:—

Estimate for Channel 100 Feet Wide.

550 oak piles, 12 to 20 feet long in place, ...	\$2,240 00
67 M spruce timber, at \$18, ...	1,206 00
6,000 pounds bolts and nails, at 3 cents, ...	180 00
Labor, ...	1,500 00
	\$5,126 00
Plus 10 per cent., ...	513 00
	Excavation:—
25,000 cubic yards, at 30 cents, ...	\$7,500 00
Plus 10 per cent., ...	750 00
	8,250 00
	\$13,889 00

The following are the statistics of the work done in making the surveys :—

Triangulation stations occupied, . . .	28
Triangulation stations determined, . . .	29
Shore lines surveyed (miles), . . .	8
Lines of soundings run (miles), . . .	83
Number of soundings taken, . . .	11,339
Lines of levels run (miles), . . .	13
Tide gauges established, . . .	7
Full tides observed, . . .	11
High and low waters observed, . . .	430
Current stations occupied, . . .	3
Current observations made, . . .	542

The results have been plotted on a series of plans, on a scale of $\frac{1}{5000}$. In addition, a plan of the South Bay has been plotted on a scale of $\frac{1}{2000}$, for the purpose of studying the best location for the proposed cut. A number of other diagrams of tidal and current observations have also been made.

Respectfully submitted,

FRANK W. HODGDON,
Engineer.

[B.]

[See page 7 of this report, *ante*.]

CONTRACT.

ARTICLES OF AGREEMENT MADE THIS FIFTEENTH DAY OF NOVEMBER, IN THE YEAR EIGHTEEN HUNDRED AND NINETY-SEVEN, BY AND BETWEEN THE COMMONWEALTH OF MASSACHUSETTS, ACTING BY THE BOARD OF HARBOR AND LAND COMMISSIONERS, WITH THE APPROVAL OF THE GOVERNOR AND COUNCIL, AND SETH PERKINS OF BOSTON, JOSEPH E. WHITE OF QUINCY, IN THE COMMONWEALTH OF MASSACHUSETTS, AND JOHN J. O'BRIEN, OF THE CITY, COUNTY AND STATE OF NEW YORK, HEREINAFTER DESIGNATED AS THE CONTRACTOR.

The contractor hereby covenants and agrees with the Commonwealth to provide all the materials and labor and to do and complete all the work necessary and proper to build a solid pier or wharf with stone retaining walls on South Boston flats in Boston harbor, and to do and complete the same in the manner and in accordance with and subject to the terms and conditions set forth in the following specifications.

The word "engineer" when used herein shall mean the engineer of the Board of Harbor and Land Commissioners, acting directly or through his properly authorized agents, such agents acting within the scope of the particular duties intrusted to them.

Specifications.

The contractor is to furnish all the plant, tools, appliances, labor and materials necessary to build and complete the pier or wharf and connect it with the adjacent filled land of the Commonwealth, including all temporary structures required for locating or marking the position of the work or any of its parts, in the following manner, to wit:—

The pier is to be located on the South Boston flats, east of and nearly parallel with Pier No. 4 of the New England Railroad Company, leaving a dock or slip about 362 feet wide between the walls of the two piers. It is to consist of a granite sea wall, resting on a pile foundation, strengthened by stone and gravel ballast, with the area enclosed by the sea wall filled solid to grade 14 feet above mean low water, with material dredged in preparing the foundations of the sea wall and from the docks on either side of the pier and at the end of the pier.

A plan on file in the office of the Board of Harbor and Land Commissioners, marked "Plan of pier to be built at South Boston flats, under the provisions of chapter 513, Acts of 1897, October 1897," and signed by Frank W. Hodgdon, engineer, shows the location, size and method of construction of the pier, and is referred to and made a part of these specifications, and is to be followed in all details not otherwise mentioned herein.

Foundation.

The flats on the site of the proposed wall and platform in front of it to be excavated to the lines shown on the plan, the excavation to be extended, at the depth of 30 feet below mean low water, to a line at least 15 feet beyond the face of the proposed platform, as shown on the plan; the excavation to be made as nearly as may be to the required lines and grades. For the wall across the outer end of the pier, and for a distance of 100 feet therefrom, up each of the side walls, the excavation immediately under the wall to be carried to a depth of 20 feet below mean low water, instead of 15 feet, as in the balance of the work. The material excavated to be used for filling the area inclosed by the walls.

In the excavation so made spruce piles are to be driven in straight rows across the wall, each row to consist of five piles spaced equally and to measure $8\frac{1}{2}$ feet from outside to outside of end piles. The rows to be $2\frac{1}{2}$ feet apart on centres. In each space between the rows an inclined spur pile to be driven, as shown on the plan.

The piles to be of spruce, sound, straight and free from large knots, and to be not less than 10 inches in diameter at the butt when cut off, and not less than 6 inches in diameter at the point when ready for driving. They are to be driven to a firm bearing not less than 15 feet into the clay and not less than 35 feet below mean low water in any case. All piles injured in driving or otherwise, or not driven in their proper places or out of line, to be removed and replaced by sound ones, at the expense of the contractor, if required by the engineer.

A spruce plank 4 by 10 inches, running the whole length of the wall for the spur piles to abut against, to be securely spiked to the front side of the middle pile in each row, with its upper edge level with the tops of the piles when cut off, and the spur piles to be fitted so as to have a firm bearing against it. All piles to be cut off even and level 6 inches below mean low water.

The main piles to be capped crosswise of the wall with 6 by 12 inch spruce timber, each stick to extend the whole width of the foundation, to be fitted so as to wholly cover and have full bearing on

all the piles in its row and to be securely fastened to the piles with 1½-inch oak treenails twelve inches long, one treenail in each pile.

Each inclined pile to be capped with a piece of the same timber, not less than 3 feet long, fitted and fastened in the same manner as the caps on the main piles. The caps to be covered with a flooring of spruce plank 3 inches thick and 8½ feet wide, securely spiked to the caps with ¾-inch wrought-iron ship spikes 6 inches long. No plank to be less than 8 inches wide.

The space between the piles and in front and rear of the same to the lines shown on the plan, extending nearly to the face of the proposed platform, to be filled with small chip stone or coarse gravel, except that the face of the slope in front of the wall, to the depth of from 18 inches to 3 feet, to be larger stone, weighing from 100 to 500 pounds, as shown on the plan. If gravel is used, at least 20 per cent. of its bulk to consist of stones having a diameter of at least 2 inches. The ballast around the piles and caps to be well rammed, and special care to be taken in doing this work not to displace any of the piles and to leave no voids around them or under the planking. The ballast back of the wall to the lines shown on the plan to consist of chip stones of such sizes as will pack closely and prevent the filling from working through the wall. If in depositing the filling back of the wall the upper portion of the ballast should be washed or pushed out of place, the ballast must be replaced, at the expense of the contractor, by other equally good material, so that upon the completion of the work there shall at no place be a thickness of less than 18 inches of ballast back of the wall.

Sea Wall.

The sea wall to extend from the bulkhead on the easterly line of the New England Railroad Company's property, about 225 feet across the end of the proposed dock or slip, then around the pier and across the end of a proposed dock or slip on the easterly side of the proposed pier to a point 200 feet easterly from the face of the side wall. The masonry to be eight feet wide at its base on the timber foundation and 4½ feet wide at its top, at grade 14 feet above mean low water, and to be built of good quality granite-quarry stone laid without mortar, the stones to be of large size, of from 1 to 3 feet in thickness, laid compactly, with good bond and full to line and grade, all the work to be done in the best manner by skilled workmen, and to have all the interstices between the stones filled solid with pinners. At least one-fourth of the stones showing in the face of the wall to be headers extending well back into the body of the wall back of the stretchers. The stones in the foundation course to be of large size, not less than 18 inches

thick, with fairly parallel beds and builds, laid with best face down on the timber foundation.

All stones in the face of the wall to have full bearing at the face without the use of pinner. The top or cap stones to extend the full width of the wall, to be not less than 18 inches thick in any part, and not less than 3 feet wide, the top surface to be split true and laid level at grade 14 feet above mean low water.

Bulkhead.

The gap left between the present bulkhead and the easterly end of the proposed sea wall to be closed by a bulkhead of spruce piles and timber, like the bulkhead which now incloses the filled portion of the Commonwealth's land.

Filling.

The area inclosed by the above-described sea wall and bulkhead, and lying between them and the existing bulkheads inclosing the filled portion of the South Boston flats, to be filled to the level of 14 feet above mean low water; first, with the material dredged in preparing the foundation for the sea wall, any additional material required to be dredged from the docks on either side of the proposed pier or from the harbor in front of the pier and docks at such places and to such depths, not exceeding 35 feet below mean low water, as may be prescribed by the engineer. All areas dredged over to be left smooth and level at the depth prescribed, and the contractor will not be required to dredge over any more area than is necessary in order to obtain the material required to complete the filling. If in the course of the dredging any ledges or boulders are found which can be removed by dredging, they are to be removed without extra payment or allowance; but if any are found which cannot be so removed, the covering material is to be dredged away and the ledges or boulders left bare to the depth of the excavation required at that place. The engineer to be the sole judge to determine whether any ledge or boulder can be removed by dredging or not.

In depositing the filling against the back ballast of the sea wall, and for a distance of 50 feet in rear of the same, great care must be used not to crowd out the wall or unnecessarily strain it in any way; and the method of doing this work must be at all times and in every detail subject to the approval and direction of the engineer.

In placing the dredged material upon the area inclosed by the walls, any method which requires that it be mixed with a large volume of water, as is done by the so-called hydraulic or suction dredges, will not be approved.

Quality of Timber.

All timber to be of spruce, sound, sawed square, of full size, even thickness, and free from large knots.

Plane of Reference.

The plane of mean low water referred to in these specifications is that established and used in the work of the improvements on the South Boston flats.

Other Contracts.

If during the continuance of this contract the Commonwealth shall proceed, by contract or otherwise, to build the platform designed to surround the face of the sea wall to be built under this contract, the same may be built without in any way affecting the terms and conditions of this contract; and it is hereby agreed that in the construction of such platform due regard shall be maintained for the rights and conveniences of each party by the other, and nothing shall be done to hinder or delay the progress of the work contemplated, but on the other hand, each party will do everything that under the circumstances is reasonably right and proper to facilitate the work of the other.

General Clauses.

The work shall be done so as not to interfere with the use of the wharf and dock of the New England Railroad Company, which adjoin the location of the pier herein contracted for.

Upon the completion of the work the contractor to remove from the premises all materials and refuse left from the construction, and to leave the premises in a condition satisfactory to the engineer.

The aforesaid plans, and the surveys, soundings and borings, with the calculations based thereon, are believed to be correct; but the contractor must examine for himself, as no allowance will be made for any errors or inaccuracies which may be found therein, and the Commonwealth does not guarantee them to be even approximately correct.

The drawings and specifications are intended to be explanatory of each other; but should any discrepancy appear, or misunderstanding arise as to the import of anything contained in either, the explanation and determination of the engineer shall be considered final and binding on the contractor. Any errors or omissions in drawings or specifications may be corrected by the engineer, such correction to govern all work only from the time that the engineer gives notice in writing thereof.

In all questions which may arise concerning measurement, lines and grades, or of interference with other work or contractors, the decision of the engineer to be final. All lines and grades will be given by the engineer, but all necessary aid and materials for giving or indicating them to be furnished by the contractor at his own expense, and the marks given shall be carefully preserved.

Any materials condemned or rejected by the engineer may be branded or otherwise marked, and shall, on demand, be at once removed from the work.

Any unfaithful or imperfect work which may be discovered before the final acceptance of the completed structure shall be corrected immediately, and any unsatisfactory materials delivered shall be rejected on the requirement of the engineer, notwithstanding that they may have been overlooked in previous inspection. The inspection of the work shall not relieve the contractor of any of his obligations to perform good work as herein described; and all work of whatever kind which, during its progress and before it is finally accepted, may become damaged from any cause, shall be removed and replaced by good and satisfactory work at the expense of the contractor, and all completed work shall be maintained by him in good condition until the final acceptance of the whole work.

The contractor hereby agrees to do such extra work in connection with the construction of the pier as may be ordered in writing by the Board of Harbor and Land Commissioners, and to accept in payment for the same, its reasonable cost as estimated by the engineer, plus 15 per cent. of said estimated cost.

The contractor to have no claim for compensation for extra work unless the same is ordered in writing by said Board, and unless the claim for the same is presented to said Board before the fifteenth day of the month following that during which each specific order is complied with.

Convenient facilities for the inspection of the work shall be furnished by the contractor whenever requested by the engineer. All instructions and directions of the engineer to be strictly observed and followed, and when the contractor is not present to receive them, they shall be received and obeyed by the superintendent or foreman who may have charge of that particular work in reference to which they are given.

All of the work to be done to the satisfaction of the engineer, and with such machinery and appliances, and by such methods, as shall be approved by him, and to the acceptance of said Board and not otherwise.

The work to be commenced as soon as practicable and to be

prosecuted vigorously in all suitable weather until completion, and to be fully completed on or before the first day of February, 1899.

In all operations connected with the work the contractor shall comply with all laws or regulations affecting in any way the conduct of those engaged on the work, or the methods of doing the work, and persons employed in the performance of manual labor under this contract shall not be required to work more than nine hours in each day, and said nine hours shall constitute a day's work; and in the employment of mechanics and laborers in the construction of the work herein contracted for preference shall be given by the contractor to citizens of the United States.

The contractor shall take all responsibility of the work and take all precautions for preventing injuries to persons and property in or about the work, and shall assume the defence of and indemnify and save harmless the Commonwealth, its officers and agents, from all actions at law and claims relating to labor or materials furnished for the work, or to inventions, patents or patent rights used in doing the work, or to injuries to any person or corporation received or sustained by or from the contractor or his employees in doing the work, or in consequence of any improper materials, implements or labor used therein, or relating to any act, omission or neglect of the contractor or his employees therein.

If the work to be done under this contract shall be abandoned by the contractor, or if the engineer at any time shall be of opinion, and shall so certify in writing to said Board of Harbor and Land Commissioners, that the work or any part thereof is unnecessarily or unreasonably delayed, or that the contractor is violating any of the provisions of this contract, said Board may notify the contractor to discontinue the work; and the contractor shall thereupon discontinue said work, and the Commonwealth may, after the said notice, complete the work by contract or otherwise, and may pay the expense of the same, so far as may be, out of any moneys then due or to become due the contractor under this contract. In case such expense is less than the sum which would have been payable under this contract if the same had been completed by the contractor, the contractor shall be entitled to receive the difference; and in case the expense shall exceed said sum, the contractor shall pay the amount of such excess to the Commonwealth.

The Harbor and Land Commissioners, for the Commonwealth, may retain out of any amounts due the contractor sums sufficient to cover any unpaid claims of mechanics, laborers or others for work done or materials furnished under this contract; *provided*, that notice in writing of such claims, signed by the claimants, shall have been previously filed with the commissioners,

It is agreed that time is of the essence of this contract, and that damages for a breach of the time covenant agreement may be assessed at the rate of \$100 for each and every day of failure on the part of the contractor to complete the same after Feb. 1, 1899, and deducted from the final payment to be made hereunder.

Estimates to be made by the engineer at the end of each calendar month of the value of the work completed in place, and payment to be made thereon of 85 per centum of the value of said work, as computed by the engineer, the remaining 15 per centum to be paid upon the final completion and acceptance of the whole work, except as hereinbefore provided.

And the Commonwealth of Massachusetts, in consideration of the performance and completion by the contractor of all of said work in the manner and in accordance with the terms and conditions aforesaid, hereby covenants and agrees to pay the contractor the sum of one hundred ninety-eight thousand four hundred and sixteen dollars (\$198,416), in full therefor, at the times and in the manner and upon the terms and conditions hereinbefore set forth.

IN WITNESS WHEREOF, on the day and year first above written, the Commonwealth of Massachusetts, by the Board of Harbor and Land Commissioners, has caused these presents to be signed and delivered in its name and behalf, and the seal of the Commonwealth to be hereto affixed, and has also caused these presents to be approved by the Governor and Council; and the said Seth Perkins, Joseph E. White and John J. O'Brien have hereunto set their hands and seals.

THE COMMONWEALTH OF MASSACHUSETTS,

By WOODWARD EMERY, } *Harbor and Land*
CLINTON WHITE, } *Commissioners.*

SETH PERKINS.

JOSEPH E. WHITE.

JOHN J. O'BRIEN.

COMMONWEALTH OF MASSACHUSETTS.

In Council, Nov. 17, 1897.

Approved:

EDWARD F. HAMLIN,
Executive Clerk.

Witness the seal of the Commonwealth:

WM. M. OLIN,
Secretary.

[SEAL OF THE
COMMONWEALTH.]

[C.]

[See page 5 of this report, *ante*]

CONTRACT.

The Bay State Dredging Company, by Augustus B. Martin, its proprietor, hereby agrees with the Commonwealth of Massachusetts, acting by its Board of Harbor and Land Commissioners, to dredge a certain portion of the material, not exceeding four thousand (4,000) cubic yards, now lying on the flats easterly of the bulkhead on the easterly side of the 70-acre lot north of Congress Street on the South Boston flats, and to deposit the same on the filled land inside of and adjoining said bulkhead.

In all questions which may arise concerning measurements, lines or grades, the decision of the engineer of said Board to be final.

Convenient facilities for the inspection of the work to be furnished by the contractor whenever requested by the engineer. All instructions and directions of the engineer to be strictly observed and followed, and, when the contractor is not present to receive them, they shall be received and obeyed by the superintendent or foreman who may have charge of the particular work in reference to which they are given.

All of the work to be done to the satisfaction of the engineer, and with such machinery and appliances, and by such methods, as shall be approved by him, and to the acceptance of said Board.

The work to be commenced at once, and prosecuted vigorously until its completion.

In all operations connected with the work, the contractor shall comply with all laws or regulations affecting in any way the conduct of those engaged on the work, or the methods of doing the work; and persons employed in the performance of manual labor under this contract shall not be required to work more than nine hours in each day, and said nine hours shall constitute a day's work; and in the employment of mechanics and laborers in the construction of the work herein contracted for, preference shall be given by the contractor to citizens of the United States.

The contractor shall take all responsibility of the work and take all precautions for preventing injuries to persons and property in or about the work, and shall assume the defence of and indemnify and save harmless the Commonwealth, its officers and agents, from all actions at law and claims relating to labor or materials furnished

for the work, or to inventions, patents or patent rights used in doing the work, or to injuries to any person or corporation received or sustained by or from the contractor or his employees in doing the work, or in consequence of any improper materials, implements or labor used therein, or to any act, omission or neglect of the contractor or his employees therein.

And the Commonwealth of Massachusetts, in consideration of the performance and completion by the contractor of all of said work in the manner and in accordance with the terms and conditions aforesaid, hereby covenants and agrees to pay the contractor the sum of sixty-five dollars (\$65) for each day (of two tides each) that the company's dredge is employed upon the work, except that, in case the average quantity of material excavated and deposited per day, with the dredge working on both tides, should fall below three hundred and fifty (350) cubic yards, the said price of sixty-five dollars (\$65) shall be reduced by such proportional amount as such average quantity actually dredged is less than said three hundred and fifty (350) cubic yards; the same to be in full therefor and to be paid upon the final completion and acceptance of the whole work.

IN WITNESS WHEREOF, on the eleventh day of March, in the year one thousand eight hundred and ninety-seven, the Commonwealth of Massachusetts, by the Board of Harbor and Land Commissioners, has caused these presents to be signed and delivered in its name and behalf and the seal of the Commonwealth to be hereto affixed, and has also caused these presents to be approved by the Governor and Council; and the said Augustus B. Martin, the proprietor of said Bay State Dredging Company, has hereunto set his hand and seal.

THE COMMONWEALTH OF MASSACHUSETTS,

By CHAS. H. HOWLAND, } *Harbor and Land*
CLINTON WHITE, } *Commissioners.*

A. B. MARTIN.

[SEAL.]

COMMONWEALTH OF MASSACHUSETTS.

In Council, March 18, 1897.

Approved:

EDWARD F. HAMLIN,
Executive Clerk.

COMMONWEALTH OF MASSACHUSETTS.

OFFICE OF THE SECRETARY.

Witness the seal of the Commonwealth:

WM. M. OLIN,
Secretary.

[SEAL OF THE
COMMONWEALTH.]

[D.]

[See page 6 of this report, *ante*.]

CONTRACT.

ARTICLES OF AGREEMENT, MADE THIS TWENTIETH DAY OF MAY, IN THE YEAR EIGHTEEN HUNDRED AND NINETY-SEVEN, BY AND BETWEEN THE COMMONWEALTH OF MASSACHUSETTS, ACTING BY THE BOARD OF HARBOR AND LAND COMMISSIONERS, WITH THE APPROVAL OF THE GOVERNOR AND COUNCIL, AND HIRAM W. PHILLIPS OF QUINCY, HEREINAFTER DESIGNATED AS THE CONTRACTOR.

The contractor hereby covenants and agrees with the Commonwealth to do and complete all the work necessary and proper to excavate and remove a ledge of rock in the channel leading to Burnham's wharf on the South Boston flats, all the work to be done and completed in the manner and in accordance with and subject to the terms and conditions set forth in the following specifications.

The word "engineer" when used herein shall mean the engineer of the Board of Harbor and Land Commissioners, acting directly or through his properly authorized agents, such agents acting within the scope of the particular duties intrusted to them.

Specifications.

The contractor to furnish all the plant, tools, appliances, labor and materials necessary to excavate and remove the ledge and dispose of the excavated material in the manner hereinafter prescribed.

The ledge to be removed is located in the easterly side of the channel leading to the wharf occupied by L. G. Burnham & Co. on the Commonwealth's flats at South Boston, and about 120 feet outside of the United States harbor line on the northerly side of said flats. It covers an area above the plane of 18.5 feet below mean low water of about 360 square feet, and is estimated to contain 47 cubic yards of rock above that plane. Its extreme length is about 30 feet, and it is about 12 feet in width. The least depth over it at mean low water is about 14.6 feet.

A plan on file in the office of the Board of Harbor and Land Commissioners, marked "Plan of ledge in Burnham's Channel, South Boston flats, April, 1897, scale $\frac{1}{80}$," and signed by Frank W. Hodgdon, engineer, gives the location and dimensions of the ledge in detail. Said plan is referred to and made a part of said specifications.

The above-described ledge is to be removed so that, upon the completion of the work herein contracted for, there will be a depth of not less than 18.5 feet of water over each and every portion of it at mean low water, but no extra payment will be allowed for any excavation below the required depth.

The rock or other material excavated or disturbed by the blasting or other means adopted for its removal shall be deposited in such place or places as may be approved by the engineer of said Board, and no portion of it shall be allowed to remain in said channel above the plane of 18.5 feet below mean low water or on the flats in the immediate vicinity of said ledge.

The aforesaid plan and the surveys and calculations based thereon are believed to be correct; but the contractor must examine for himself, as no allowance will be made for any errors or inaccuracies which may be found therein.

In all questions which may arise concerning measurements, lines and grades, the decision of the engineer to be final. All lines and grades will be given by the engineer; but all necessary aid and materials for giving or indicating them to be furnished by the contractor at his own expense, and the marks given shall be carefully preserved.

Convenient facilities for the inspection of the work to be furnished by the contractor whenever requested by the engineer. All instructions and directions of the engineer to be strictly observed and followed; and when the contractor is not present to receive them, they shall be received and obeyed by the superintendent or foreman who may have charge of the particular work in reference to which they are given.

All the work to be done to the satisfaction of the engineer, and with such machinery and appliances, and by such methods, as shall be approved by him, and to the acceptance of said Board.

The work to be commenced as soon as practicable, and to be prosecuted vigorously in all suitable weather until completion, and to be fully completed on or before the thirty-first day of July, 1897, and will be paid for upon its completion.

In all operations connected with the work, the contractor shall comply with all laws or regulations affecting in any way the conduct of those engaged on the work, or the methods of doing the

work ; and persons employed in the performance of manual labor under this contract shall not be required to work more than nine hours in each day, and said nine hours shall constitute a day's work ; and in the employment of mechanics and laborers in the construction of the work herein contracted for, preference shall be given by the contractor to citizens of the United States.

The contractor shall take all responsibility of the work and take all precautions for preventing injuries to persons and property in or about the work, and shall assume the defence of and indemnify and save harmless the Commonwealth, its officers and agents, from all actions at law and claims relating to labor or materials furnished for the work, or to inventions, patents, or patent rights used in doing the work, or to injuries to any person or corporation received or sustained by or from the contractor or his employees in doing the work, or in consequence of any improper materials, implements or labor used therein, or to any act, omission or neglect of the contractor or his employees therein.

If the work to be done under this contract shall be abandoned by the contractor, or if the engineer at any time shall be of opinion, and shall so certify in writing to said Board of Harbor and Land Commissioners, that the work or any part thereof is unnecessarily or unreasonably delayed, or that the contractor is violating any of the provisions of this contract, said Board may notify the contractor to discontinue the work, and the contractor shall thereupon discontinue said work, and the Commonwealth may thereupon complete the work by contract or otherwise, and may pay the expense of the same so far as may be out of any moneys then due or to become due the contractor under this contract. In case such expense is less than the sum which would have been payable under this contract if the same had been completed by the contractor, the contractor shall be entitled to receive the difference ; and in case the expense shall exceed said sum, the contractor shall pay the amount of such excess to the Commonwealth.

And the Commonwealth of Massachusetts, in consideration of the performance and completion by the contractor of all of said work in the manner and in accordance with the terms and conditions aforesaid, hereby covenants and agrees to pay the contractor the sum of seven hundred and seventy seven (777) dollars in full therefor, at the time and in the manner and upon the terms and conditions hereinbefore set forth.

IN WITNESS WHEREOF, on the day and year first above written, the Commonwealth of Massachusetts, by the Board of Harbor and Land Commissioners, has caused these presents to be signed and delivered in its name and behalf, and the seal of the Common-

wealth to be hereto affixed, and has also caused these presents to be approved by the Governor and Council ; and the said Hiram W. Phillips has hereunto set his hand and seal.

THE COMMONWEALTH OF MASSACHUSETTS,

By WOODWARD EMERY, } *Harbor and Land*
CLINTON WHITE, } *Commissioners.*

HIRAM W. PHILLIPS.

[SEAL.]

COMMONWEALTH OF MASSACHUSETTS.

In Council, May 27, 1897.

E. F. HAMLIN,
Executive Clerk.

[SEAL OF THE
COMMONWEALTH.]

OFFICE OF THE SECRETARY, May 27, 1897.

Witness the seal of the Commonwealth :

WM. M. OLIN,
Secretary of the Commonwealth.

[SEAL OF THE
COMMONWEALTH.]

[E.]

[See page 35 of this report, *ante*]

REPORT OF THE SUPERINTENDENT, PROVINCE LANDS.

PROVINCETOWN, MASS., Dec. 1, 1897.

To the Board of Harbor and Land Commissioners.

GENTLEMEN:—As Superintendent of the Province Lands I respectfully submit the following report for the year ending Nov. 30, 1897:—

Our season's work commenced about the middle of April with the transplanting of shrubs and young trees from the nursery along the base of the outer range of sand hills, extending the work eastward from that of previous years and opposite the beach-grass work of the season of 1896. In this locality there were transplanted about 35,000 young pines, 5,000 silver poplars, 4,000 tamarisk, 500 locust and 2,000 Scotch broom (*Genista scoparia*). Of the young pines transplanted, about one-half were of one year's growth and the other half were of two and three years' growth, from seed planted in the nursery, and consisted of four varieties, viz.: native pitch pine (*Pinus rigida*), seaside pine (*Pinus maritima*), Scotch pine (*Pinus sylvestris*), and Austrian Pine (*Pinus Austriaca*). Excellent results have been obtained in transplanting the above varieties, with the exception of the seaside pine, which has not borne transplanting with a great degree of success, not more than 10 per cent. living, while of the other varieties 80 per cent. survived transplanting, made fine growth during the season and are now in excellent condition. The poplars, tamarisk, locust, and especially Scotch broom, show results equally as good as pines. The fine growth of the Scotch broom the past season and its present very favorable condition seem to warrant a more extensive use of this shrub in future work.

After completing the work of transplanting trees and shrubs, we commenced the work of beach-grass planting about the last of April. Beginning at the western end of the first or inner range of sand hills, extending eastward along the slope, we continued the work until June 2, and covered an area of 20 acres. In connection with the planting of beach grass, the area was covered with pine seeds of the varieties named above used in transplanting, sown broadcast over the ground as the grass planting was

going on. The result of both the grass planting and the seeding with pine has been highly satisfactory; the grass took root readily and made good growth, and the seeds germinated abundantly and withstood the dry and hot weather of the summer without detriment.

About the middle of September we resumed the work of grass planting, beginning at the point where we stopped in June, and continued eastward along the same slope, covering about 22 acres, making a total area covered by this season's work of about 42 acres, extending along the slope for a distance of about 4,000 feet. This section covered by the fall planting has also been thickly planted with acorns gathered in the adjacent woods, and which germinate and grow readily in the sands. We have also planted among the grass along the slope covered during the seasons of 1895 and 1896, with very favorable results, pine seeds of the varieties named, covering about 20 acres, also about 10 acres on the south side of the same range.

We have made use of a considerable quantity of the bayberry (*Myrica cerifera*), a shrub which grows abundantly in certain portions of the lands, is of considerable value for preliminary covering of the work, and easily survives transplanting.

We have continued work upon the nursery to a limited extent, have seeded it with pine, principally, and have now a number of young plants which will be ready for transplanting another season. The nursery is quite important, especially for the starting of such trees and shrubs as need a good root growth before transplanting into the sands on the outer beach.

Nigger Head Road, which was completed last season as far as the summit of Grand View Hill, has been extended about 400 feet in the direction of Race Point Life Saving Station. This road, as far as Grand View has been much used by the public, and in consequence some labor has been required for repairs. It is now in good condition. Other roads through the lands have been kept safe and convenient for travel at small expense.

In closing operations for the season brush has been used, as in the past, for the protection of the work done.

The planting done during the seasons of 1895 and 1896, especially seed planting, is now showing gratifying results. It was thought at the commencement that seed planting would not be a success in the sand, that the hot and dry weather of midsummer would destroy the young plants, and that we should have to depend almost entirely upon nursery stock for transplanting; but from experiments made, especially with the various kinds of pine seed, last season's results seem to prove that seed can be successfully

used, and, in connection with nursery stock, with great saving of expense and labor. A small space planted with pine seeds in the spring of 1896 shows a remarkable growth, some of the young plants attaining a growth of 10 inches; the same may be said also of about 1 acre planted with acorns, some of the young oaks making a growth of about 12 inches.

The beach-grass work already accomplished has worked in every way to our satisfaction. Throughout the whole section covered not a single break has been made by the action of the wind, and no movement of sand observed. Up to the present time about 70 acres have been covered with grass; a large part of this surface has been filled in with either trees, shrubs or seed.

The condition of the work already done will justify the statement that a continuation of the improvement upon lines pursued the past season will accomplish the reclamation of these lands of the Commonwealth.

Respectfully submitted,

JAMES A. SMALL,
Superintendent Province Lands.

[F.]

[See page 39 of this report, *ante*.]

REPORT OF E. C. AND E. E. DAVIS, ENGINEERS.

To the Honorable Board of Harbor and Land Commissioners of Massachusetts, WOODWARD EMERY, Esq., Chairman.

GENTLEMEN : — We herewith submit our report of work done the past season on the western bank of Connecticut River, in the town of Agawam, Mass., under the appropriation made in chapter 58 of the Resolves of the Legislature of Massachusetts in 1897.

After an examination of the river bank by your Board in August last, it was decided to expend the appropriation on the following sections of the bank and in the order named, these being places where the encroachments of the river endangered the safety of the highway and the permanency of the protective works that have been built by the State during the past three years; and we have followed the directions of your Board in the prosecution of the work.

Section 1. — A continuation of the work, up the river, from where it was stopped in 1896, in front of and above the premises of Mr. John Riley.

Section 2. — A continuation of the work, down the river, from where it was stopped in 1896, below the house of Mr. James Green.

Section 3. — A reach of the river bank in front of the premises of Mr. Sumner Clark, between sections 1 and 2.

On Section 1 the work has been extended up the river for a distance of 229 feet, to a point where the growth of trees and brush affords a natural protection to the river bank.

On Section 2 the work has been extended down the river 162 feet, on the same grades and lines established in the work of 1896, covering and protecting all that part of the bank in this locality where the river was approaching the lines of highway travel.

On Section 3 the bank has been graded and brought to a slope of 3 to 1 for a distance of 369 feet up and down the river, and protective work laid on this slope.

On all the sections the same plan of protection has been pursued as in former years: first grading the banks on straight lines and uniform slopes, and then covering the slopes with mats made of

poles and fine brush, wired together and overlaid with riprap of broken stone.

The requirements of your contract with Mr. William H. Porter of Agawam, for furnishing stone for the riprapping, have been faithfully carried out on his part, and he has furnished 194.56 cubic yards of stone for this purpose, in compliance with the terms of the specifications for the same.

The total amount of surface covered by the protective works the past season was 2,157 square yards, costing \$1,455.75, being an average cost of about 67½ cents per square yard.

The sum of \$43.30 has been expended in repairs on work done in the past three years, and in turfing and covering with brush small patches on the river bank at different points where there was danger of the river breaking through the natural protection to the bank afforded by the growth of turf and small brush, making the total expenditures of the season \$1,499.05, leaving an unexpended balance of the appropriation of 1897 of 95 cents.

In consideration of an arrangement made by your Board with the selectmen of Agawam, whereby the town is to furnish funds to meet the expenses of setting willows next spring, in the work done the past season no reservation of funds from the appropriation of 1897 has been made for this purpose.

The tools, ropes, etc., that have been purchased from time to time for use on the work are in the care of Mr. W. C. Campbell, the foreman employed on the work, and are subject to your orders.

In conclusion, we are of the opinion that the town of Agawam and its highways are now thoroughly protected from any further encroachments at present of the Connecticut River, and that no further appropriations will be required for this work.

Respectfully submitted,

E. C. AND E. E. DAVIS,
Engineers.

NORTHAMPTON, MASS., Dec. 7, 1897.

[G.]

[See page 36 of this report, *ante*.]

CONTRACT.

The Board of Harbor and Land Commissioners of the Commonwealth and Mr. Charles E. Davis of New Bedford agree as follows:—

Charles E. Davis will remove the wreck of the schooner “W. F. Miller,” lying at the entrance of Cotuit harbor, in the town of Barnstable, so that no stick or timber thereof shall remain either below or above low-water mark, and will remove all material not destroyed on the spot to some suitable place above high-water mark, to be found by him.

The Board agree that, if said Davis removes said wreck, as aforesaid, to its satisfaction, it will pay him the sum of two hundred and fifty (250) dollars.

WITNESS our hands, this twenty-ninth day of September, 1897.

BOARD OF HARBOR AND LAND COMMISSIONERS,

By WOODWARD EMERY.

CLINTON WHITE.

CHARLES E. DAVIS.

[H.]

[See page 36 of this report, *ante*.]

CONTRACT.

The Board of Harbor and Land Commissioners of the Commonwealth and Mr. George W. Townsend of Boston agree as follows :—

George W. Townsend will remove the wreck of the sloop yacht "Galena," now lying sunken in the lower middle in Boston harbor, so that no portion thereof shall remain in tide water, and will deposit all material removed on filled portion of the South Boston flats, at such place as may be designated by the Board. Said Townsend shall use every endeavor to secure any watches, money, jewelry or other personal effects now in said wreck, and deliver the same, in as good condition as when found, to said Board, as soon as discovered.

The Board agree that, if said Townsend removes said wreck as aforesaid to its satisfaction, it will pay him the sum of forty-nine (49) dollars.

WITNESS our hands, this twenty-ninth day of September, 1897.

GEORGE W. TOWNSEND.

WOODWARD EMERY, } Board of Harbor and
CLINTON WHITE, } Land Commissioners.

[I.]

[See page 10 of this report, *ante*.]

COMMONWEALTH OF MASSACHUSETTS.

SUPERIOR COURT.

SUFFOLK, SS.

MAYOR AND ALDERMEN OF THE CITY OF BOSTON, PETITIONERS FOR
ALTERATION OF THE GRADE CROSSING OF CONGRESS STREET AND
THE ROAD OF THE NEW ENGLAND RAILROAD COMPANY IN THE
CITY OF BOSTON.

DECISION AND REPORT OF COMMISSION.

The commissioners heretofore appointed upon said petition, and directed, by chapter 535 of the Laws of the Commonwealth of Massachusetts for the year 1896, to “prescribe the manner in which the grade crossing of Congress Street and the railroad of the New York & New England Railroad Company (now the New England Railroad Company) shall be abolished,” agreeably to the provisions of said act, decide and report as follows : —

First. — Acting under the authority given by our appointment, and under chapter 535 of the Laws of 1896, we notified the city of Boston, the New England Railroad Company and the Commonwealth that we would meet the parties interested at No. 27 School Street, in the city of Boston, on the twentieth day of June, 1896, and at that time and place we met.

The city of Boston appeared by its corporation counsel; the Commonwealth appeared by the Second Assistant Attorney-General, J. Mott Hallowell; the New England Railroad Company appeared by its counsel, J. H. Benton, Jr.; and the Boston Wharf Company appeared by its treasurer, J. B. Russell.

Upon conference with the parties who thus appeared we gave notice that we would hear all parties interested in the matter of said petition and of said act on Wednesday, the first day of July, 1896, by publishing a notice in three daily newspapers published in the city of Boston, of which the following is a copy : —

CONGRESS STREET GRADE CROSSING. — COMMISSIONERS' NOTICE.

The commissioners appointed by the superior court, on petition of the mayor and aldermen of the city of Boston, for the alteration of the crossing of Congress Street and the road of the New York & New England Railroad Company, in the city of Boston, and to whom were referred

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certain matters incident to the alteration of said crossing, by chapter 535 of the Acts of the General Court of Massachusetts, for the year 1896, hereby give notice that they will meet to hear all parties interested in the matter of said petition and of said act, on Wednesday, the first day of July, A.D. 1896, at half-past ten o'clock in the forenoon, at the office of the Railroad Commissioners in said city of Boston.

GEORGE W. WIGGIN,
CHARLES A. ALLEN,
EDWARD B. BISHOP,
Commissioners.

Boston, June 22, 1896.

Pursuant to said notice, we met at the rooms of the Railroad Commissioners in the city of Boston on July 1, 1896, at which time the city of Boston appeared by its corporation counsel; the Commonwealth appeared by the Second Assistant Attorney-General, J. Mott Hallowell; the New England Railroad Company appeared by its counsel, J. H. Benton, Jr.; and the Boston Wharf Company appeared by its counsel, William E. Russell.

The city engineer presented a plan for the proposed alteration of the grade crossing, and after hearing the parties present, and all persons who desired to be heard, we adjourned the hearing until the sixth day of October, 1896, at the same place.

Oct. 6, 1896, we met pursuant to adjournment at the rooms of the Railroad Commissioners in the city of Boston.

The Commonwealth appeared by the Second Assistant Attorney-General; the city of Boston by Andrew J. Bailey, corporation counsel; the New England Railroad Company by J. H. Benton, Jr., its counsel; and the Boston Wharf Company by Mr. Wilson; and after hearing the parties present, and all persons who desired to be heard, we adjourned the hearing to Friday, the sixteenth day of October, 1896, at the same place.

Oct. 16, 1896, we met pursuant to adjournment at the rooms of the Railroad Commissioners in the city of Boston.

The Board of Harbor and Land Commissioners of the Commonwealth appeared by Woodward Emery, its chairman; the city of Boston by Andrew J. Bailey, corporation counsel; the New England Railroad Company by J. H. Benton, Jr., counsel; the Boston Wharf Company by C. T. Russell, counsel, and by J. B. Russell, treasurer; Thomas Cunningham, a land owner, who claimed that his interests would be affected by the proposed alteration, appeared in person; and the Walworth Manufacturing Company, a land owner which claimed that its interests would be affected by the proposed alteration, appeared by J. J. Myers, its counsel.

We heard all parties who appeared as above stated, and all persons who desired to be heard, and considered plans and estimates presented by the city engineer of the city of Boston for the proposed alteration, and then adjourned the hearing until the twenty-sixth day of October, at the same place.

Oct. 26, 1896, we met pursuant to adjournment at the rooms of the Railroad Commissioners in the city of Boston.

The Commonwealth appeared by the Second Assistant Attorney-General; the city of Boston appeared by its corporation counsel; the railroad company appeared by J. H. Benton, Jr., its counsel; the Boston Wharf Company appeared by C. T. Russell, its counsel, and by J. B. Russell, its treasurer, and the three street commissioners of Boston appeared in person.

And after hearing all parties who appeared as above stated, and all persons who desired to be heard, we adjourned the hearing until the tenth day of November, 1896, at the office of George W. Wigin, chairman of the commissioners, in the Tremont building in the city of Boston.

Pending these adjournments, we personally visited and inspected the crossing and the locality affected by the alteration thereof at several times.

On the 10th of November, 1896, the commissioners met pursuant to adjournment, and prescribed the manner in which said crossing shall be abolished, as follows, to wit:—

DISCONTINUANCE OF STREET.

That portion of Congress Street east of a point on that street about three hundred eighty-eight and eighteen one-hundredths (388.18) feet east of the easterly boundary of A Street over the railroad and land of the New England Railroad Company to the westerly side line of B Street is discontinued, except that the city of Boston shall have the right to construct and maintain necessary sewers and water pipes therein.

SUBSTITUTE STREET.

In substitution of that portion of Congress Street hereinabove discontinued, and as an adequate substitute therefor, a new street and approaches thereto are hereby located, said approaches being necessary in our judgment to render such new street an adequate substitute for that portion of Congress Street which is hereinabove discontinued, and an adequate substitute “for any other existing public ways across the lands or railroad of the New England Railroad Company northerly of West First Street, except Northern Avenue, as heretofore required to be constructed.”

DESCRIPTION OF NEW STREET.

Said new street begins at a point eighty (80) feet distant north-westerly from and at right angles to the harbor line on the westerly side of Fort Point Channel, and three hundred and twelve and five one-hundredths (312.05) feet distant south-westerly from the southerly line of Congress Street as now located, measured on a line distant at right angles eighty (80) feet from and parallel with the said harbor line.

The northerly side line of said new street runs from said point south-easterly across Fort Point Channel and land on the easterly side thereof two thousand three hundred eighty-eight and eighty-four one-hundredths (2,388.84) feet to a point in the westerly side line of B Street twenty-two and forty-eight one-hundredths (22.48) feet southerly from the southerly side line of Congress Street, as now located; from said last-named point the northerly side line of said new street runs south-easterly about eleven hundred seventy-one and five one-hundredths (1,171.05) feet to a point twelve and five-tenths (12.5) feet northerly from and at right angles to the northerly side line of Congress Street as now located, extended in the same course five hundred and sixty-five (565) feet easterly from the most easterly point in said northerly line of Congress Street; and from said last-named point the northerly side line of said new street runs south-easterly about fourteen hundred sixty-two and twenty-two one-hundredths (1,462.22) feet to a point in the bulkhead line on the northerly side of the "Reserved Channel," distant fifty (50) feet at right angles from the centre line of "L Street bridge."

The southerly side line of said new street runs from a point in said bulkhead line one hundred forty-eight and fifty-nine one hundredths (148.59) feet westerly from the intersection of said northerly side line with said bulkhead line north-westerly parallel to and one hundred (100) feet from said above-described northerly side line about forty-eight hundred eighty-six and seventy-two one-hundredths (4,886.72) feet to a point eighty (80) feet distant north-westerly at right angles from the aforesaid harbor line of Fort Point Channel.

DESCRIPTION OF APPROACHES.

First Approach.

The first approach required, as hereinabove stated, is located as a public way, and bounded and described as follows, viz.:—

Beginning at a point in the south-easterly side line of Atlantic

avenue as now located, at the intersection of said side line with the south-westerly side line of Congress Street as now located, the westerly side line of said approach runs in the south-westerly side line of Congress Street five hundred thirty-four and eighty-nine one-hundredths (534.89) feet to a point distant eighty (80) feet north-westerly at right angles from the harbor line on the westerly side of Fort Point Channel; thence said side line runs south-westerly three hundred twelve and five one-hundredths (312.05) feet parallel to and eighty (80) feet from the said harbor line of Fort Point Channel to the north-easterly side line of said new street as hereinabove located and described.

The easterly side line of said approach begins at a point in the south-easterly side line of Atlantic avenue as now located about eighty and twenty-three one-hundredths (80.23) feet north-easterly in said side line of Atlantic avenue from the point begun at in the above description of the westerly side line, and runs thence south-easterly parallel to and eighty (80) feet from said westerly side line about five hundred seventy-nine and twenty-one one-hundredths (579.21) feet to the said harbor line of Fort Point Channel; thence on said harbor line about three hundred sixty-nine and twenty-six one-hundredths (369.26) feet to the north-easterly side line of said new street as above located and described.

Second Approach.

The second approach required as hereinabove stated is located as a public way, and bounded and described as follows, viz. : —

Beginning at a point in the westerly side line of A street as now located one hundred sixty (160) feet southerly from the southerly side line of said new street as hereinabove located and described, the north-easterly side line of said approach runs north-westerly about five hundred seventeen and seventy-nine one-hundredths (517.79) feet to a point sixty (60) feet measured at right angles from the southerly side line of said new street; thence by a curve of sixty (60) feet radius about eighty-three and seventy-two one-hundredths (83.72) feet to the southerly side line of said new street.

The south-westerly side line of said approach begins at a point in the southerly side line of said new street seventy-four and ninety-five one-hundredths (74.95) feet north-westerly from the intersection of said north-easterly side line of said approach with the southerly side line of said new street, and runs south-easterly in a straight line about sixty-one and seventy-three one-hundredths (61.73) feet to a point distant sixty (60) feet at right angles from the north-easterly side line of said approach above described;

thence south-easterly sixty (60) feet from and parallel to said north-easterly side line about six hundred forty and fifty-seven one-hundredths (640.57) feet to the westerly side line of A Street.

Third Approach.

The third approach, required as hereinabove stated, is located as a public way, and bounded and described as follows : —

Beginning at a point on the northerly line of Congress Street as laid out by the street commissioners, March 14, 1879, fifty-five (55) feet westerly on said line from the easterly end thereof, one side line of said approach runs southerly at right angles to said northerly line of Congress Street four hundred ten and sixty-two one-hundredths (410.62) feet; thence easterly at right angles six hundred twenty (620) feet; thence northerly at right angles to the last-described line three hundred twenty-two and sixty-seven one-hundredths (322.67) feet to the southerly line of said new street, as hereinbefore located and described.

The other side line of said approach begins at a point on the prolongation of the said northerly line of Congress Street, five (5) feet easterly from the easterly end thereof, and runs southerly at right angles to said northerly line of Congress Street, three hundred sixty and sixty-two one-hundredths (360.62) feet; thence easterly at right angles to the last-described line, four hundred eighty (480) feet; thence northerly at right angles to the last-described line, two hundred sixty-five and thirteen one-hundredths (265.13) feet to the southerly line of said new street as hereinbefore located and described.

GRADES.

Said new street and approaches are hereby laid out and are to be constructed at the following described grades, viz. : —

Grades of New Street.

The grade of the southerly curb of the new street begins at the most westerly point thereof at an elevation of twenty-two and fifty one-hundredths (22.50) feet above the Boston city base; thence the grade runs by an ascending grade not exceeding one and seventy-five one-hundredths (1.75) feet per hundred feet for about eighty and thirty-three one-hundredths (80.33) feet to elevation twenty-three and thirty-eight one-hundredths (23.38) feet; thence by an ascending grade of one and seventy-five one-hundredths (1.75) feet per hundred (100) feet about sixty-nine and seventy-one one-hundredths (69.71) feet to elevation twenty-four and sixty one-hundredths (24.60) feet; thence by a vertical curve eighty-two and fifty one-hundredths (82.50) feet to elevation twenty-five and

fifty one-hundredths (25.50) feet; thence level three hundred forty-six and fifty-seven one hundredths (346.57) feet; thence by a vertical curve ninety-nine and eighty-one one-hundredths (99.81) feet to elevation twenty-six and ninety-two one-hundredths (26.92) feet; thence by an ascending grade of one and seventy-five one-hundredths (1.75) feet per one hundred (100) feet five hundred forty-seven (547) feet to elevation thirty-six and fifty one-hundredths (36.50) feet; thence by a vertical curve seventy (70) feet to elevation thirty-seven and twenty-five one-hundredths (37.25) feet; thence by an ascending grade of ninety one-hundredths (0.90) feet per one hundred (100) feet three hundred forty-five (345) feet to elevation forty and thirty-seven one-hundredths (40.37) feet; thence by a vertical curve of thirty (30) feet to elevation forty and fifty one-hundredths (40.50) feet; thence level to the westerly line of B Street, so called; thence by a vertical curve eighty (80) feet to elevation forty and twenty one-hundredths (40.20) feet; thence by a descending grade of about seventy-four one-hundredths (0.74) feet per one hundred (100) feet four hundred sixty-eight (468) feet to elevation thirty-six and seventy-two one-hundredths (36.72) feet; thence by a vertical curve of sixty (60) feet to elevation thirty-six and five one-hundredths (36.05) feet; thence by a descending grade of one and fifty one-hundredths (1.50) feet per one hundred (100) feet thirteen hundred and six and sixty-six one-hundredths (1,306.66) feet to elevation sixteen and forty-five one-hundredths (16.45) feet; thence by a vertical curve of sixty (60) feet to elevation sixteen (16) feet; thence level to the present grade of L Street bridge.

The grade of the northerly curb of the new street is the same as described for the southerly curb, except where it may be necessary to modify it in order that the curbs may be at the same elevation on opposite sides of the street.

Grade of First Approach.

The grade of the first approach above described begins at a point in the south-easterly side line of Atlantic Avenue, and runs at the grade of Congress Street as now established, to the harbor line on the westerly side of Fort Point Channel; thence in a rising grade not exceeding one and six-tenths (1.6) feet in one hundred (100) feet with the necessary curves for connecting the same to the grade of said new street as hereinabove established.

Grade of Second Approach.

The grade of the second approach above described begins at the westerly side line of A Street at a point sixteen (16) feet above the city base, and runs generally with a grade of one and seven-

tenths (1.7) feet per one hundred (100) feet with necessary curves for connecting the same with A Street and the new street to the grade of the new street as above established.

Grade of Third Approach.

The grade of the third approach above described begins at the grade of said new street as hereinabove established at its junction therewith, and thence runs by a descending grade not exceeding one and one-half ($1\frac{1}{2}$) feet per one hundred (100) feet to the line of Fargo Street (so called); thence by a descending grade not exceeding one and seven-tenths (1.7) feet per one hundred (100) feet to an elevation of sixteen (16) feet above the city base at the line of C street (so called); thence in said elevation to Congress Street; with the necessary curves for connecting the same to the grade of said new street, as hereinabove established.

IN GENERAL.

The location and grades of said new street and approaches are shown on six (6) plans thereof, herewith filed as a part of this report, verified by the signatures of the commissioners, and dated March 2, A.D. 1897.

CONSTRUCTION OF NEW STREET.

Said new street and approaches connected therewith, as above provided, shall be constructed at the grades above specified in the following manner:—

First.—That portion thereof over Fort Point Channel shall consist of a bridge of four deck spans of iron or steel plate girders resting on masonry piers and abutments, and two retractile draws spanning a clear channel-way of fifty (50) feet.

The masonry abutments and piers are to be built of granite laid solid in cement, and to rest on foundations of piles and concrete.

The foundations of the piers shall be so constructed that the channel through the draw opening may be dredged to the depth of twenty-three (23) feet below mean low water without endangering the stability of any portion of the bridge.

The fixed portions of the bridge are to have paved roadways seventy-six feet wide between curb lines, and two sidewalks each twelve (12) feet wide, the walks to have an asphalt wearing surface and to be protected by iron railings on their outer edges.

Each draw is to be of about half the width of the street, and to be entirely independent of the other.

The main girders and floor beams are to be of iron or steel, the

floor joists of hard pine timber and the flooring to be of two courses of plank.

The draws are to be carried by trucks running on rails which will rest on steel beams or timber stringers, and they in turn to be supported by piles.

The motive power for the draws is to be electricity, but provision is to be made for hand or horse power to be used in an emergency.

Suitable fenders and draw piers are to be provided and connected with the present pier of Congress Street bridge.

Second. — That portion thereof between Fort Point Channel and A Street shall be constructed as follows : —

An abutment shall be built on the line of Fort Point Channel with return walls with suitable filling for a distance of about twenty-five (25) feet on both sides of the street, and for the remainder of the distance to A Street the new street shall be suitably filled within timber bulkheads.

The roadway of this section shall be seventy-six (76) feet wide, and paved and curbed with granite, and have a sidewalk on each side twelve (12) feet wide with plank surface.

Third. — That portion thereof over A Street shall consist of a bridge to span the full width of that street, and be similar in construction to the spans of the bridge over Fort Point Channel, and rest on masonry abutments with foundations of piles and concrete.

Fourth. — That portion thereof between A Street and the land of the New England Railroad Company shall be filled solid with suitable filling supported by timber bulkheads, with a roadway seventy-six (76) feet wide, paved and curbed with granite, with a sidewalk on each side twelve (12) feet wide, with a plank surface.

Fifth. — That portion thereof over the land and railroad of the New England Railroad Company shall consist of a bridge with four spans, the first of which on the west shall be about one hundred (100) feet, and the others about two hundred (200) feet, supported on stone abutments at either end of the bridge, and on rolled steel riveted columns, bolted to stone or concrete piers supported on piles. The abutment at B Street shall be provided with two openings about ten feet wide from about grade sixteen (16) to grade twenty-six (26), for access to the New England Railroad land from B Street.

The bridge superstructure shall be of steel, and each span shall have two side trusses with centres placed about ten (10) feet inside from each street line, and one or two middle trusses with overhead bracings so arranged as to give not less than seventeen (17) feet clear headway over the roadway for teams.

The floor of the bridge shall be of steel floor beams and stringers of either steel or wood, covered with plank treated with some preservative process, with a roadway seventy-six (76) feet wide, less necessary allowance for trusses, paved with granite and curbed with stone or iron, and an asphalt sidewalk twelve (12) feet wide on each side.

The trusses, floor posts and foundations shall be of sufficient strength to support a live load equal to one hundred pounds per square foot, or an alternative load of twenty tons on a space five feet by twelve feet, the twelve feet to be measured parallel with the trusses of the bridge, and the bridge shall be of such height as to give a clear way underneath up to elevation 35.25, and the curb grade not to exceed elevation 40.5 feet each from the city base.

Sixth. — That portion thereof over B Street shall consist of a bridge with a clear span of eighty (80) feet and a clear headroom of nineteen (19) feet above the street at its present grade. This bridge shall rest on masonry abutments, the easterly abutment to be similar to those at A Street.

The superstructure of the bridge shall consist of through plate girders with overhanging sidewalks. The roadway shall be seventy-six (76) feet wide, with necessary allowance for trusses, paved with granite and curbed with granite or iron, with an asphalt sidewalk twelve (12) feet wide on each side.

Seventh. — That portion thereof between B and C streets shall have abutments with return walls of sufficient length to prevent the filling from sloping into those streets, and shall be filled solid with suitable filling; and on the southerly street line the portion abutting on the property of Thomas Cunningham shall have a timber bulkhead to retain the filling, and on that portion abutting on the land of the Commonwealth the filling shall have a side slope of one and one-half to one; and on the northerly street line for the entire distance between B and C streets the filling shall be supported by a bulkhead of timber or by a wall of masonry.

This portion shall have a roadway of seventy-six (76) feet wide, paved with granite and curbed with granite or iron, and a sidewalk twelve (12) feet wide on each side, with a wearing surface of crushed stone or plank.

Eighth. — That portion thereof over C Street shall consist of a bridge with two deck spans supported at the centre of the street by steel columns resting on a masonry pier, carried to a height of three feet above C Street grade, and shall have a pile and concrete foundation. The abutments of this bridge shall be similar to those at A Street, and the bridge shall have a paved roadway seventy-six (76) feet wide and granite or iron curbs, and an

asphalt sidewalk twelve (12) feet wide on each side, and shall have a clear headroom on the street below of not less than sixteen and a half ($16\frac{1}{2}$) feet.

Ninth. — That portion thereof between C Street and L Street bridge shall have return walls from the abutment on C Street of sufficient length to prevent the filling from sloping onto C Street, and shall be filled from the abutment to L Street Bridge with suitable filling, with side slopes of one and a half to one, excepting that on the southerly line the portion abutting upon the lot leased to George C. Corcoran shall have a timber bulkhead to retain the filling.

This portion shall have a roadway seventy-six (76) feet wide, paved with granite and curbed with granite or iron, and a sidewalk twelve (12) feet wide on each side, with a wearing surface of crushed stone or plank.

CONSTRUCTION OF FIRST APPROACH.

Tenth. — The first approach leading from Atlantic Avenue to said new street shall be filled solid with suitable filling, supported where necessary by a sea-wall, and shall have a roadway paved and curbed with granite sixty (60) feet wide, with a sidewalk on each side ten (10) feet wide paved with brick.

CONSTRUCTION OF SECOND APPROACH.

Eleventh. — The second approach, leading from A Street to said new street, shall be filled with suitable filling and supported with timber bulkheads for such distance as is necessary for filling exceeding seven (7) feet in height; and the remainder of the distance to A Street shall be filled with suitable filling with side slopes of one and a half to one, and the surface shall be paved and curbed with granite, with a roadway forty (40) feet wide and a sidewalk ten (10) feet wide on each side with plank surface.

CONSTRUCTION OF THIRD APPROACH.

Twelfth. — The third approach leading from Congress Street to said new street shall be constructed of suitable filling with slopes of one and a half to one, with a roadway paved and curbed with granite, the roadway to be two-thirds the width of said approach, with a sidewalk on each side of said approach one-sixth the width of said approach, the sidewalks to be surfaced with crushed stone.

Under the bridge on the new street hereinbefore described the roadway may be made of the same clear width as on the balance of the street, the sidewalks to be narrowed accordingly.

All sidewalks shall have suitable fences on the street lines.

The material for filling all the slopes shall be clean sand or gravel.

LAND TAKINGS.

To make the alterations above prescribed, it is necessary to take for street purposes the following-described parcels of land, which are hereby taken for said purposes:—

1. A parcel of land supposed to belong to the Boston Terminal Company, being a strip eighty (80) feet wide, bounded easterly by the harbor line on the westerly side of Fort Point Channel, about one hundred and forty-one one-hundredths (100.41 feet); southerly, westerly and northerly by other land supposed to belong to the said Boston Terminal Company, respectively about eighty and thirty-three one-hundredths (80.33) feet, about one hundred and forty-one one-hundredths (100.41) feet, and about eighty and thirty-three one-hundredths (80.33) feet; and containing eight thousand and thirty-three (8,033) square feet, more or less.

2. A parcel of land supposed to belong to the Boston Wharf Company, being a strip of land one hundred (100) feet wide, bounded northerly by other land supposed to belong to said Boston Wharf Company, about six hundred sixty-one and fifty-four one-hundredths (661.54) feet; easterly by the westerly side of A Street, about one hundred and four one-hundredths (100.04) feet; southerly by other land supposed to belong to said Boston Wharf Company, about six hundred sixty-one and eighty-one one-hundredths (661.81) feet; and westerly by the harbor line on the easterly side of Fort Point Channel, about one hundred and three one-hundredths (100.03) feet; and containing sixty-six thousand one hundred sixty-seven (66,167) square feet, more or less.

3. A parcel of land supposed to belong to the Boston Wharf Company, being a strip one hundred (100) feet wide, bounded northerly by other land supposed to belong to said Boston Wharf Company, about three hundred eighty-one and fourteen one-hundredths (381.14) feet; easterly by land supposed to belong to the New England Railroad Company, about one hundred and four one-hundredths (100.04) feet; southerly by other land supposed to belong to said Boston Wharf Company, about three hundred eighty-one and fourteen one-hundredths (381.14) feet; and westerly by the easterly line of A Street, about one hundred and four one-hundredths (100.04) feet; and containing thirty-eight thousand one hundred fourteen (38,114) square feet, more or less.

4. A parcel of land supposed to belong to Thomas Cunningham, bounded northerly by other land supposed to belong to said

Cunningham, about one hundred seventy-nine and ten one-hundredths (179.10) feet; also northerly by the southerly line of Congress Street, about ninety-six and sixty-nine one-hundredths (96.69) feet; easterly by land supposed to belong to the Commonwealth of Massachusetts, about ninety-one and thirty-two one-hundredths (91.32) feet; southerly by other lands of said Cunningham, about two hundred seventy-six and twenty-two one-hundredths (276.22) feet; and westerly by the easterly line of B Street, about one hundred and forty-four one-hundredths (100.44) feet; and containing twenty-seven thousand one hundred eighty-one (27,181) square feet, more or less.

5. A parcel of land supposed to belong to the Commonwealth of Massachusetts, bounded northerly by the southerly line of Congress Street, about two hundred ten and eighty-seven one-hundredths (210.87) feet; easterly by the westerly line of C Street, about seventy-one and forty-three one-hundredths (71.43) feet; southerly by other land of the Commonwealth, about two hundred eleven and eighty-one one-hundredths (211.81) feet; and westerly by land supposed to belong to Thomas Cunningham, about ninety-one and thirty-two one-hundredths (91.32) feet; and containing seventeen thousand one hundred sixty (17,160) square feet, more or less.

6. A parcel of land supposed to belong to the Commonwealth of Massachusetts, bounded northerly by other land supposed to belong to the Commonwealth, about two thousand twenty-four and seventy-one one-hundredths (2,024.71) feet, measured on two lines respectively about five hundred sixty-two and forty-nine one-hundredths (562.49) feet and about fourteen hundred sixty-two and twenty-two one-hundredths (1,462.22) feet; southerly by the seawall built on the northerly side of the Reserved Channel, so called, about one hundred forty-eight and fifty-nine one-hundredths (148.59) feet; also southerly by other land supposed to belong to said Commonwealth, about nineteen hundred fourteen and eighty-one one-hundredths (1,914.81) feet, measured on two lines respectively about thirteen hundred forty-seven and sixty one-hundredths (1,347.60) feet and about five hundred sixty-seven and twenty-one one-hundredths (567.21) feet; and westerly by a line parallel to and five (5) feet distant from the easterly line of C Street as defined in the laying out of Congress Street by the street commissioners of the city of Boston, March 14, 1879, and the prolongation of said line about one hundred and forty-four one-hundredths (100.44) feet; and containing one hundred ninety-six thousand nine hundred seventy-six (196,976) square feet, more or less.

7. A parcel of land supposed to belong to the Boston Real

Estate Trust, being a strip of land twenty (20) feet wide, bounded northerly by other land supposed to belong to the said Boston Real Estate Trust, about four hundred forty-seven and forty-nine one-hundredths (447.49) feet; easterly by land belonging to a person or persons unknown, about twenty and twenty-nine one-hundredths (20.29) feet; southerly by the northerly line of Congress Street, about four hundred fifty-two and forty-five one-hundredths (452.45) feet; and westerly by the easterly line of Atlantic Avenue, about twenty and six one-hundredths (20.06) feet; and containing eight thousand nine hundred ninety-nine (8,999) square feet, more or less.

8. A parcel of land belonging to a person or persons unknown, bounded northerly by land belonging to a person or persons unknown, about one hundred thirty-one and seventy-two one-hundredths (131.72) feet; easterly by the harbor line on the westerly side of Fort Point Channel, about thirteen and thirty-three one-hundredths (13.33) feet; southerly by the northerly line of Congress Street, about one hundred thirty-five and seventy-three one-hundredths (135.73) feet; and westerly by land supposed to belong to the Boston Real Estate Trust, about twenty and twenty-nine one-hundredths (20.29) feet; and containing two thousand six hundred eight (2,608) square feet, more or less.

9. A parcel of land supposed to belong to the Boston Real Estate Trust, bounded northerly by the southerly line of Congress Street, about forty and fifty-six one-hundredths (40.56) feet; easterly by land supposed to belong to the Boston Electric Light Company, about eighty-four and two one-hundredths (84.02) feet; and westerly by other land supposed to belong to the said Boston Real Estate Trust, about ninety-three and forty-three one-hundredths (93.43) feet; and containing seventeen hundred four (1,704) square feet, more or less.

10. A parcel of land supposed to belong to the Boston Electric Light Company, bounded northerly by the southerly line of Congress Street, about forty-six and thirty one-hundredths (46.30) feet; measured on four lines, respectively three and thirty-eight one-hundredths (3.38) feet, twenty and eighty one-hundredths (20.80) feet, one and eighty one-hundredths (1.80) feet and twenty and thirty-two one-hundredths (20.32) feet; easterly by the harbor line on the westerly side of Fort Point Channel, about two hundred ninety-five and eighty-nine one-hundredths (295.89) feet; southerly by land supposed to belong to the Boston Terminal Company, about eighty and ninety-eight one-hundredths (80.98) feet; and westerly by other land supposed to belong to said Boston Electric Light Company, about two hundred thirteen and twenty-

nine one-hundredths (213.29) feet; and by land supposed to belong to the Boston Real Estate Trust, about eighty-four and two one-hundredths (84.02) feet; and containing twenty-two thousand fifty-three (22,058) square feet, more or less.

11. A parcel of land supposed to belong to the Boston Terminal Company, bounded northerly by land supposed to belong to the Boston Electric Light Company, about eighty and ninety-eight one-hundredths (80.98) feet; and southerly and westerly by other lands supposed to belong to the Boston Terminal Company, respectively about eighty and thirty-three one-hundredths (80.33) feet and about five and thirty-three one-hundredths (5.33) feet; and containing two hundred thirteen (213) square feet, more or less.

12. A parcel of land supposed to belong to the New England Railroad Company, bounded easterly by the westerly line of A Street, about thirty-three and seventy-three one-hundredths (33.73) feet; south-westerly by land supposed to be a part of the location of said New England Railroad, about one hundred sixty-six and eighty-three one-hundredths (166.83) feet, measured on the arc of a circle of twelve hundred eighty-six and fifty-seven one-hundredths (1,286.57) feet radius; and northerly by other land supposed to belong to said New England Railroad Company, one hundred fifty-five and ninety-seven one-hundredths (155.97) feet; and containing twenty-two hundred sixty-seven (2,267) square feet, more or less.

13. A parcel of land supposed to be a part of the location of the New England Railroad, bounded easterly by the westerly line of A Street, about twenty-seven and seventy-nine one-hundredths (27.79) feet; southerly by land supposed to belong to the said New England Railroad Company, about five and fifty-eight one-hundredths (5.58) feet; south-westerly by other land supposed to belong to said New England Railroad Company, about six hundred and twenty one-hundredths (600.20) feet, measured on two lines, respectively about five hundred eleven and sixty-nine one-hundredths (511.69) feet, on the arc of a circle of twelve hundred sixty and fifty-seven one-hundredths (1,260.57) feet radius, and eighty-eight and fifty-one one-hundredths (88.51) feet; westerly by other land supposed to be part of the location of said New England Railroad, thirty-three and sixty-one one-hundredths (33.61) feet, measured on the arc of a circle of one hundred twenty (120) feet radius; and northerly by land supposed to belong to the Boston Wharf Company, about one hundred twelve and ninety-six one hundredths (112.96) feet, measured on two lines respectively one hundred nine and sixty-four one-hundredths

(109.64) feet and three and thirty-two one-hundredths (3.32) feet, on the arc of a circle of twelve hundred eighty-six and fifty-seven one-hundredths (1,286.57) feet radius; also northerly by other land within the location of said railroad, about three hundred forty-three and thirty-one one-hundredths (343.31) feet; and north-easterly by land of the last-described parcel, about one hundred sixty-six and eighty-three one-hundredths (166.83) feet, measured on the arc of a circle of twelve hundred eighty-six and fifty-seven one-hundredths (1,286.57) feet radius; and containing thirteen thousand three hundred eighty-one (13,381) square feet, more or less.

14. A parcel of land supposed to belong to the New England Railroad Company, bounded south-westerly by land supposed to belong to the Boston Wharf Company, about four hundred thirty-two and sixty-five one hundredths (432.65) feet, measured on two lines, respectively three hundred eighty-eight and sixteen one-hundredths (388.16) feet, on the arc of a circle of twelve hundred thirty-four and fifty-seven one-hundredths (1234.57) feet radius, and forty-four and forty-nine one-hundredths (44.49) feet; westerly by other lands supposed to belong to said New England Railroad Company, about fifty-one and fifty-one one-hundredths (51.51) feet, measured on the arc of a circle of one hundred twenty (120) feet radius; northerly and north-easterly by land of the last-described parcel six hundred and twenty one-hundredths (600.20) feet, measured on two lines, respectively eighty-eight and fifty-one one-hundredths (88.51) feet and five hundred eleven and sixty-nine one-hundredths (511.69) feet, on the arc of a circle of twelve hundred sixty and fifty-seven one-hundredths (1,260.57) feet radius; and southerly by other land of said New England Railroad Company, one hundred seventeen and four one-hundredths (117.04) feet; and containing thirteen thousand six hundred twenty-one (13,621) square feet, more or less.

15. A parcel of land supposed to belong to the Boston Wharf Company, bounded northerly and north-easterly by the last-described parcel of land, about four hundred thirty-two and sixty-five one-hundredths (432.65) feet, measured on two lines, respectively forty-four and forty-nine one-hundredths (44.49) feet and three hundred eighty-eight and sixteen one-hundredths (388.16) feet, on the arc of a circle of twelve hundred thirty-four and fifty-seven one-hundredths (1,234.57) feet radius; and southerly by other land supposed to belong to said Boston Wharf Company, about four hundred thirty and sixty-nine one-hundredths (430.69) feet, measured on two lines, respectively about four hundred eight and seventy-eight one hundredths (408.78) feet and about twenty-

one and ninety-one one-hundredths (21.91) feet, on the arc of a circle of one hundred twenty (120) feet radius; and containing fifty-six hundred ninety (5,690) square feet, more or less.

16. A parcel of land supposed to belong to the Boston Wharf Company, bounded northerly by the southerly line of said new street, about seventy-four and ninety-five one-hundredths (74.95) feet; northerly by other land supposed to belong to said Boston Wharf Company, about one hundred two and twenty-three one-hundredths (102.23) feet, measured on two lines, respectively about eighty-three and seventy-two one-hundredths (83.72) feet, on the arc of a circle of sixty (60) feet radius, and about eighteen and fifty-one one-hundredths (18.51) feet; southerly by land supposed to be part of the location of the New England Railroad, one hundred and twelve and ninety-six one-hundredths (112.96) feet, measured on two lines, respectively three and thirty-two one-hundredths (3.32) feet, on the arc of a circle of twelve hundred eighty-six and fifty-seven one-hundredths (1,286.57) feet radius and one hundred nine and sixty-four one-hundredths (109.64) feet; and westerly by other land supposed to belong to said Boston Wharf Company, sixty-three and eighty-seven one-hundredths (63.87) feet, measured on two lines, respectively two and fourteen one-hundredths (2.14) feet, on the arc of a circle of one hundred twenty (120) feet radius, and sixty-one and seventy-three one-hundredths (61.73) feet; and containing four thousand three hundred six (4,306) square feet, more or less.

17. A parcel of land supposed to belong to the Commonwealth of Massachusetts, being a strip of land eighty (80) feet wide, bounded northerly by the southerly line of said new street as hereinbefore described, about eighty and thirty-five one-hundredths (80.35) feet; and easterly, southerly and westerly by other lands supposed to belong to said Commonwealth, respectively about three hundred twenty-two and sixty-seven one-hundredths (322.67) feet, eighty (80) feet and about three hundred fifteen and thirteen one-hundredths (315.13) feet; and containing twenty-five thousand five hundred twelve (25,512) square feet, more or less.

18. A parcel of land supposed to belong to said Commonwealth, being a rectangular strip of land fifty (50) feet wide, bounded easterly by the last-described parcel fifty (50) feet; and southerly, westerly and northerly by other land supposed to belong to said Commonwealth, respectively about four hundred eighty (480) feet, fifty (50) feet and about four hundred eighty (480) feet; and containing twenty-four thousand (24,000) square feet, more or less.

19. A parcel of land supposed to belong to said Commonwealth, being a rectangular strip sixty (60) feet wide, bounded easterly by

the last-described parcel fifty (50) feet and by other lands of the Commonwealth about two hundred eighty-five and sixty-two one-hundredths (285.62) feet; northerly by the southerly line of Congress Street and the prolongation of said line sixty (60) feet; westerly and southerly by other lands of the Commonwealth, respectively about three hundred thirty-five and sixty-two one-hundredths (335.62) feet and sixty (60) feet; and containing twenty thousand one hundred thirty-seven (20,137) square feet, more or less.

20. A parcel of land supposed to belong to the said Commonwealth, being a rectangular strip of land five (5) feet wide and seventy-five (75) feet long, bounded northerly by the prolongation of the northerly line of Congress Street as now laid out five (5) feet; southerly by the prolongation of the southerly line of said street five (5) feet; westerly by the easterly line of C Street as defined in the laying out of said Congress Street seventy-five (75) feet; and easterly by a line parallel to and five (5) feet from the last described line seventy-five (75) feet; and containing three hundred seventy-five (375) square feet, more or less.

21. A parcel of land supposed to be within the location of Congress Street as now laid out, being a rectangular strip of land fifty-five (55) feet wide and seventy-five (75) feet long, bounded northerly by lands supposed to belong to the Commonwealth of Massachusetts, fifty-five (55) feet; easterly and southerly by other parcels of land hereinbefore described, respectively seventy-five (75) feet and fifty-five (55) feet; and westerly by other land within the location of Congress Street seventy-five (75) feet; and containing forty-one hundred twenty-five (4,125) square feet, more or less.

22. For the purpose of maintaining the bridge over the land and tracks of the New England Railroad Company above described, and so far as it is required for that purpose, it is necessary to take the following-described parcel of land supposed to belong to the New England Railroad Company, being a strip of land one hundred (100) feet wide, bounded northerly by other lands supposed to belong to the said railroad company, about seven hundred fourteen and seven one-hundredths (714.07) feet; easterly by the westerly side line of B Street about one hundred one and thirty-six one-hundredths (101.36) feet; southerly by other lands supposed to belong to the said railroad company, about six hundred ninety-four and sixty-three one-hundredths (694.63) feet; and westerly by lands supposed to belong to the Boston Wharf Company, about one hundred and four one-hundredths (100.04) feet; and containing seventy thousand four hundred thirty-five (70,435) square feet, more or less.

All of said parcels of land are shown upon the plans hereinbefore mentioned.

The hearing was then continued and adjourned from time to time, for the purpose of hearing the parties upon the proportions in which the expenses of the alterations and improvements hereinbefore prescribed, including damages occasioned by the taking of land and by the alteration and construction of highways and bridges, as required by this report, and including the cost of the hearing and the compensation of the commissioners and auditors for their services and expenses, shall be borne by the parties ; and now, having fully heard the parties, their evidence and arguments, and having fully considered the same, and all the relations of the parties, we decide that the Commonwealth shall pay thirty-one per cent. thereof, the city of Boston thirty per cent. thereof, and the New England Railroad Company thirty-nine per cent. thereof.

We decide that the work required by this report shall be done by the city of Boston and the New England Railroad Company, as follows : —

The New England Railroad Company is to build the bridge over the land of said company, including the abutments, and the city of Boston shall do all the other work required by this decision.

Dated this second day of March, A.D. 1897.

GEORGE W. WIGGIN, CHARLES A. ALLEN, EDWARD B. BISHOP,	}	<i>Commissioners.</i>
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